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Editorial

THE ECONOMIC VALUE OF VETERINARY RESEARCH.

THE article on "Pine" which appears in this month's issue is another illustration of the value of the collaboration of a number of those who have broadmindedly made special studies of certain aspects of disease from different outlooks. In this particular instance the veterinary and the agricultural were the sides at issue, and the result which has been attained has been well worth the efforts made to successfully overcome the difficulties which were met with.

Pioneers always meet, and expect to meet, with difficulties, and those engaged in research not only know that full well, but are surprised (and may even wonder what is wrong) if they do not meet with strenuous opposition of some kind or other—often from a source least expected and least welcome.

The Committee at the Moredun Institute are to be congratulated upon the work which has already been, and still is being, carried on there.

The agriculturists and dairymen of Great Britain alone owe a debt to Professor Russell Greig which money can never repay. Even if one takes his patient researches into milk fever alone, the dairy industry has been saved millions of pounds annually, for his writings have been translated into every European language;

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and the opportunity to carry out the treatment of a milk-fever case is now *welcomed* by the practising veterinarian, whereas only a few years ago he always *dreaded* a call to visit an animal suffering from this ailment. Research into animal disease takes time, but it pays for itself many times over, not only by the actual lives it saves, but by the economic aspect it produces by its value in the *prevention* of future epidemics.

The work done so successfully by Russell Greig and Dryerre at Moredun, by Gaiger and Dalling (so ably followed up by Stewart) under the auspices of the Armstrong College, together with that of Montgomerie, of Bangor, have saved the sheep breeders in this country hundreds of thousands of pounds already; and when to that is added the knowledge which the work of Russell Greig and Little on milk fever has brought to the cause and treatment of milk fever in cattle, and the result of the work of Laidlaw, Dunkin and Dalling in regard to distemper, the economic value of the amount rises into an amount which cannot be estimated; and this applies only to successes attained within a decade.

Truly a legitimate peg upon which to hand a claim for more opportunities (financial and otherwise) to be given to veterinary science, and studies in veterinary *preventive* medicine, by trained veterinary scientists.

General Articles

PINE: A DISEASE AFFECTING SHEEP AND YOUNG CATTLE.

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IN COLLABORATION WITH
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The Rowett Research Institute, Aberdeen,
AND
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The Macaulay Institute for Soil Research, Aberdeen.

THE disease of sheep and young cattle known as " pine," has been recognised in this country for at least a century ; the condition is characterised by emaciation, lethargy, and inco-ordination of gait, and usually terminates fatally. An early and full account is given by Hogg, the Ettrick Shepherd,[1] who was a very acute observer on all matters concerning sheep husbandry. He observed that the disease generally affected all the sheep in a flock, but that in the great majority of cases recovery took place if the animals were changed to another type of pasture. Since Hogg's time the condition has been recognised in many parts of the country, being variously known as " pining," " vinquish," and " daising."

M'Gowan and Smith[2] investigated the conditions of the occurrence of " pine " on the northern slopes of the Cheviots, and they were able to confirm and elaborate the observations of Hogg. They found that the disease could be prevented by feeding the sheep on succulent pasture, or by putting them to feed on a " break " of turnips. They suggested that the cause of the disease might be a deficiency of an accessory food factor, although it was realised by these authors that some of the evidence did not support this view. Conditions of wasting or pining in animals have also been observed in countries other than Scotland. Their wide geographical distribution has tended to obscure the fact that these diseases are similar in character. Thus, in New Zealand, sheep and cattle are afflicted with a disease known as " bush sickness," and the similarity of this condition to pine is commented upon by Godden and Grimmett.[3] They refer to the work of Aston,[4] who showed that pasture containing an abnormally low content of iron is the determining factor in bush sickness. On comparing the pastures from affected and non-affected lands, they found, in general, a lower content of iron in the former, and they refer to the fact that in the case of bush sickness the administration of iron and ammonium citrate elicited markedly beneficial results. The curative action of iron has also been observed in the condition known as " Nakuruitis," which is prevalent in the Nakuru district of Kenya. The animals, after grazing on the affected pasture for four to five months, become anæmic, emaciated, and unsteady

in their gait. The condition has been investigated by Orr,[5, 6] who was able to show that the administration of licks composed of salt and ferric oxide effected a cure, and he is of the opinion that pine, bush sickness and Nakuruitis are closely related to one another. In Florida[7] a condition known as " salt sick " has been noted, and in this case also the administration of salt and ferric oxide together with copper sulphate effected a cure. In all instances a change to non-affected pasture will prevent the disease, or, if it be already established, a cure can be effected if the change be made timeously.

Our attention was drawn to the acute condition of pine which occurs on the island of Tiree. This island, one of the Inner Hebrides, is thirty-four square miles in extent, and is treeless, low and flat. We are indebted to Mr. J. Simpson, of H.M. Geological Survey, for the following short description of the geology of Tiree :

" Three clearly-contrasted types of terrain are present in Tiree. These are: (1) Raised beach ; (2) blown sand ; (3) rock with little or no soil.

" The *Raised Beaches* form ill-defined platforms, often interrupted by rock outcrops, at various levels up to 100 feet. The type of material in them is gravel, or gravelly sand. The individual sand grains are often rust-stained, and irregular iron-cemented layers or iron-pan have been noted in some pits. Raised beaches occupy more than a third of the total area of the island.

" The *Blown Sand* forms extensive spreads on the raised beach at numerous localities along the seaboard where the coast line is low, and even extends in broad belts from sea to sea at The Reef, and between Gott Bay and Vaul Bay. The sand is in places heaped into low dunes, but for the most part forms comparatively flat grass-covered tracts. A very high content of shell fragments is a noticeable feature of the sand. Altogether, blown sand must occupy an area nearly as great as that of the raised beaches.

" *Rock with little or no soil covering* forms the higher ground (above 100 feet) at Ben Hough, Ceann a' Mhara, Ben Hynish, and near Scarinish, and also appears throughout the raised-beach area in numerous knobs and hummocks, varying in size from a few square yards to a few acres in extent. Geologically, the rocks are gneisses of various kinds, for the most part of an acid or sub-acid nature. Basic types are also present, but are of less importance. Limestone (marble) and lime-rich gneisses are also present, and rocks of this nature are believed to underlie the Reef and a part of the Gott Bay-Vaul Bay area. It is not considered, however, that in these areas the underlying solid rocks will affect the surface soil, as it is most probable that raised-beach deposits intervene between the solid rock and the blown sand."

It has long been recognised that although the pasture on Tiree is luxuriant, when sheep or young cattle are grazed continuously upon certain parts of the island, especially the areas of blown sand, a number are liable to become affected with pine. If, however, at the end of three or four weeks the animals be shifted from these " thriftless " areas to parts of the raised-beach terrain for a fortnight

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MAP OF TIREE

The light portions represent the areas of Blown Sand on which Pine occurs. The shaded portions refer to the Raised Beach areas (see text.)

Reproduced from the Ordnance Survey Map with the sanction of the Comptroller of H.M. Stationery Office.

(Lithographers : Hislop & Day, Edinburgh.)

(Article by J. Russell Greig and Henry Dryerre, *page 99*)

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or so, they can again be grazed safely for another period of three or four weeks upon the affected pastures. In other words, so long as a shift is made at intervals of not more than three to four weeks, the animals appear to thrive as well on one type of grazing as on another. This fact suggested that a dietetic deficiency existed upon the affected grazing.

Although, as has been indicated, the early symptoms of pine can be noted after a period as short as three or four weeks, more commonly the symptoms develop only after the animals have been grazed continuously on the affected pasture for a period of two to three months.

In 1930, it was resolved to investigate the nature of pine as it occurred in Tiree, and during that grazing season samples of grass from the Reef, that is, "thriftless" pasture, and samples from the raised beach, that is, a "non-pine" area, were collected and analysed at the Rowett Research Institute. The results are shown in Appendix, Table A. The figures refer to the percentage of dry matter. It will be seen that in each set of samples there is considerable variation between the different grasses off the same soil. On the whole, the grasses off the Reef are poorer in nitrogen and phosphoric acid, but richer in soluble ash and lime than those off the raised beach. Subsequently composite samples of the herbage on the two types of soil were taken at approximately monthly intervals and sent in for analyses. The results for the first three samples in each case are given in Appendix, Table B. As in the previous set, it will be seen that the samples off the Reef are poorer in nitrogen and phosphoric acid, but richer in lime, than the corresponding samples off Hylipol, a "non-pine" area; but in this set they are poorer also in soluble ash.

In both sets there is a rise in the lime content of the herbage as the season advances, but as regards phosphoric acid, there is a slight rise in the cases of the Reef samples, but a drop for the Hylipol samples. The ratio $CaO : P_2O_5$ shows very little variation due to season in the Reef samples, the range being only 4–3, whereas in the other samples the range in this ration is 1–2.6. The iron was not estimated in these samples owing to the contamination of the herbage with soil. This contamination might also have slightly raised the lime content of the herbage from the pine area owing to the high lime-content of the soil, but the effect would not be very great, and not at all comparable with the effect on the percentage of iron in the herbage. For the purpose of comparison it may be observed that the last samples of the pasture from the raised beach area compare favourably with the average composition of Scottish hill pasture, as found by Godden.[8]

The symptoms of "pine," as it occurs in Tiree, are those of a progressive debility, accompanied by anæmia and emaciation. The onset is frequently insidious. The affected animal is dull, and the coat, in the case of cattle, is rough and staring, the visible mucous membranes, especially the conjunctiva, become pale; physical condition is gradually lost, the eyeball becomes sunken, and there is commonly a serous discharge from the inner canthus. In young animals

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growth is markedly retarded, and they soon present a stunted, unthrifty appearance. Thereafter the anæmia and emaciation progress to the condition of cachexia, and, finally, as the result of extreme weakness, the animal is unable to rise. In severe cases the gait is stilted and somewhat inco-ordinated.

Since, as has been mentioned, the clinical symptoms of pine in Tiree presented a marked similarity to those of bush sickness and Nakuruitis, and since these diseases had been shown to respond to the administration of iron, it was decided, after consultation with Dr. J. B. Orr, to carry out a field experiment during the 1931 grazing season in order to test the effects of rationing supplementary minerals. Accordingly twenty-one young island cattle of nondescript breeding were purchased. These animals averaged about 3–4 cwt. in weight, but since no weighing facilities were obtainable on the island their weights were not definitely determined. Some of these animals had been bred on pining areas, and the early signs of pine were actually in evidence. The twenty-one cattle after inspection were numbered by ear tags, and divided into three groups of seven, care being taken that each group was closely comparable with the others, according to the place of origin, breeding, size and condition. Samples of blood were then withdrawn from each of the animals for the purpose of chemical analysis. Because of the difficulties in the transport of apparatus, and the lack of facilities, it was not possible to carry out the entire chemical examination on the island. It was decided, therefore, to concentrate on the estimation of the glucose, inorganic phosphorus, and hæmoglobin. The remaining constituents were estimated on return to the Moredun Institute.

Technique.

Two samples of blood were withdrawn from the jugular vein of each animal: one was allowed to clot, and the serum was used for calcium estimation; the other was preserved with potassium oxalate and sodium fluoride. The addition of the fluoride has been shown to delay glycolysis.[9] Within half an hour of the collection of the blood a measured portion was precipitated with trichloracetic acid in order to delay hydrolysis of the phosphoric esters. Only enough of the filtrate was removed as was required for the estimation of the inorganic phosphorus, the remainder for the estimation of the organic phosphorus being left in contact with the precipitate, as recommended by Malan.[10] The hæmoglobin was estimated colorimetrically in the form of acid hæmatein, a Newcomer glass standard being used throughout the series. The blood was diluted 1 part in 400, and the results expressed according to the formula $\frac{153.6}{R}$ = percentage hæmoglobin. Table I gives the results of the blood analyses in so far as concerns calcium, inorganic phosphorus and hæmoglobin.

The chemical analyses were carried through without any knowledge of the condition of the individual animals. The assessment of the physical condition was made by one of us, in conjunction with Mr. Hugh MacKinnon, a practical stocksman, who undertook the supervision of the animals during the experiment.

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It was found that the physical condition of the animals ran almost *pari passu* with the hæmoglobin content of the blood, the greater the amount of the hæmoglobin, the better the physical condition. It may be observed that, with the exceptions of Nos. 255, 256, and 267, all the animals showed a lower hæmoglobin percentage than the average previously found for healthy animals, which amounted to 10.25 per cent.

TABLE I.—BLOOD ANALYSES. COMMENCEMENT OF EXPERIMENT.
APRIL 30TH TO MAY 1ST, 1931.

No.	Sex	Ca. mg. per 100 c.c. serum	Inorg. P. mg. per 100 c.c. blood.	Hb. per cent.
		GROUP I.		
251	F.	9.6	8.00	7.96
252	F.	10.6	6.06	7.57
253	F.	10.9	6.60	8.00
254	M.	10.6	6.06	8.23
255	M.	11.6	5.55	10.75
256	F.	11.1	5.37	10.45
257	F.	11.3	6.15	8.10
Average	...	10.8	6.26	8.72
		GROUP II.		
259	F.	10.4	6.95	8.70
260	M.	11.3	6.67	8.23
261	M.	10.5	5.10	8.10
262	F.	11.4	7.55	9.50
263	F.	11.3	5.75	9.60
264	F.	11.6	6.15	8.45
265	F.	10.1	5.33	7.50
Average	...	10.9	6.21	8.58
		GROUP III.		
266	M.	8.8	7.35	6.28
267	F.	10.6	6.56	10.25
268	F.	10.6	6.56	9.05
269	F.	11.3	5.41	9.22
270	F.	10.8	6.51	8.45
272	M.	11.4	6.95	9.43
274	F.	10.3	5.72	8.22
Average	...	10.5	6.44	8.70

All three groups were put to graze in fenced enclosures on the " pining " land. *Group I* was retained as a control group. *Group II* received a mineral allowance consisting of sodium chloride, 1 oz., and ferric oxide, 1 oz., per animal per day. *Group III* received a daily mineral mixture consisting of sodium chloride, 1 oz., ferric oxide, 1 oz., dicalcium phosphate, 1 oz. per animal. A quantity of sugar beet pulp was also mixed with the minerals in order to render them palatable. All the animals of each group had free access to a common drinking trough.

Since, as has been indicated, there were no facilities on the island for weighing the animals, their progress could not, therefore, be followed by that means.

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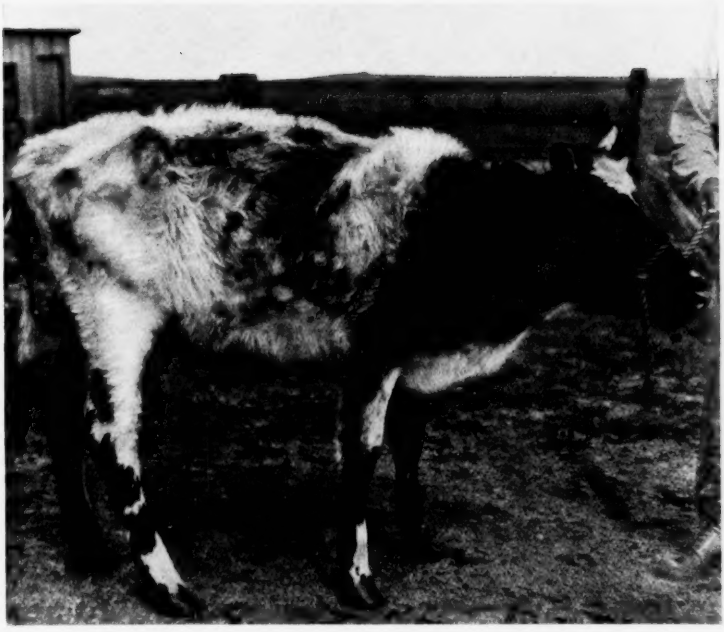
For economic reasons it was impracticable to visit Tiree periodically for the purpose of obtaining blood specimens, and it was therefore decided to allow the experiment to run for about three months, and to return to the island for the purpose of assessing the general condition of the animals, and of obtaining further specimens of blood. At the end of twelve weeks the island was revisited, and the same procedures as on the former occasion were carried through. Samples of blood were withdrawn from each of the animals, and were analysed as before. The result of these analyses is given in Table II.

TABLE II.—BLOOD ANALYSES. END OF EXPERIMENT.

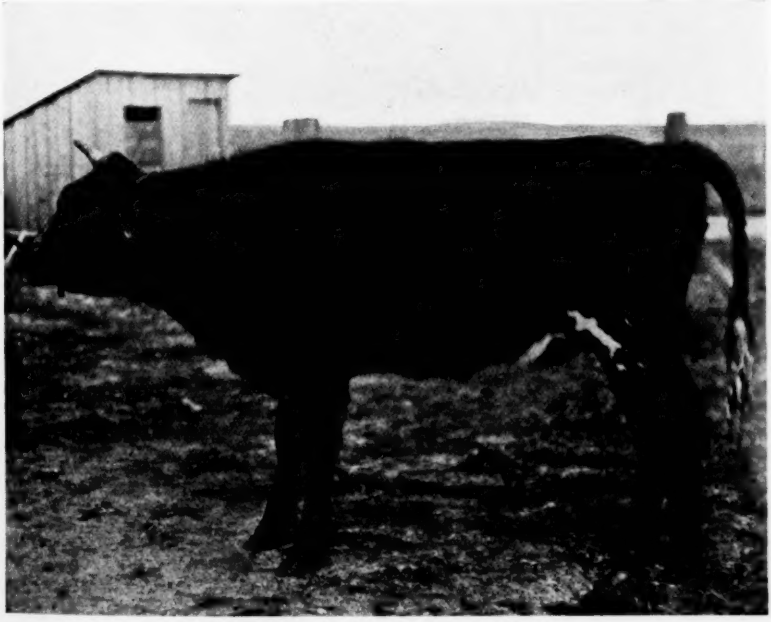
July 22ND–23RD, 1931.

No.	Ca. mg. per 100 c.c. serum	Inorg. P. mg. per 100 c.c. blood.	Hb. per cent.
GROUP I.			
251	8.9	3.85	7.48
252	9.6	5.80	8.20
253	10.6	5.84	6.12
254	10.9	6.35	8.29
255	11.2	5.10	9.63
256	11.3	5.93	8.47
257	11.7	5.88	9.64
Average ...	10.6	5.54	8.26
GROUP II.			
259	10.3	7.84	8.03
260	11.6	5.37	8.47
261	11.7	5.48	9.75
262	10.7	5.51	8.00
263	11.2	4.91	10.20
264	11.3	4.88	9.35
265	12.0	3.85	8.03
Average ...	11.3	5.41	8.83
GROUP III.			
266	9.8	5.75	6.37
267	10.0	4.76	8.96
268	10.4	6.96	8.96
269	10.9	5.48	9.06
270	10.9	6.56	8.80
272	11.1	5.26	8.16
274	Died during course of experiment		
Average ...	10.5	5.80	8.39

Examination of Tables I and II will show the changes in the percentage amounts of the blood constituents in the individual animals, and in their averages for each group. It will be observed that there were no significant changes in the composition of the blood of the animals of any group, taking each group as a whole. Although it was difficult to find a basis upon which to assess the degree of change, whether for better or worse in the general condition of the animals, an attempt was made to do so by com-



Control Animal No. 251 at end of experiment, showing typical symptoms of " Pine."



Treated Animal No. 266 at end of experiment, showing complete recovery. At the commencement of the experiment, this animal was the most severely affected of any in the three groups.

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paring the notes taken at the beginning and the end of the experiment (see Table III). On this occasion we had in addition the assistance of Mr. John Wilson, County Organiser to the West of Scotland Agricultural College, as an independent observer, and he had no difficulty in separating the treated from the non-treated animals.

TABLE III.

GROUP I.

Distinguishing Colour—White (Control).

No.	Sex	Physical Condition: At beginning of experiment	Physical Condition: At end of experiment	Age in Years
251	F.	Pining	Pining	1
252	F.	Fair	Marked improvement	¾
253	F.	Fair	Improvement	1
254	M.	Fair	Improvement	1
255	M.	Fairly good	Slight improvement	1
256	F.	Good	Unthrifty	1
257	F.	Fair	Marked improvement	1

GROUP II.

Distinguishing Colour—Red (Ferric Oxide and Salt).

259	F.	Pining	Very marked improvement	1
260	M.	Fair	Very marked improvement	1
261	M.	Fair	Improvement	1¼
262	F.	Fair	Improvement	1
263	F.	Fairly good	Very marked improvement	1
264	F.	Fairly good	Improvement	1
265	F.	Pining	Marked improvement	1

GROUP III.

Distinguishing Colour—Black (Ferric Oxide, Dicalcium phosphate, Salt).

266	M.	Pining	Very marked improvement	1
267	F.	Fair	Marked improvement	1
268	F.	Fair	Marked improvement	1
269	F.	Fair	Improvement	1¼
270	F.	Fair	Marked Improvement	1
272	M.	Fair	Marked improvement	1¼
274	F.	Pining	Died*	1

*This animal died early in the course of the experiment from an intercurrent disease.

Of the five animals (Nos. 251, 259, 265, 266 and 274) which showed definite symptoms of pine at the commencement of the experiment, No. 266 was the most severely affected. At the end of the experiment, however, his physical condition was even better than that of Nos. 259 and 265, which then showed no signs of the disease, and were thriving satisfactorily. All the animals in the control group showed a harsh skin and a staring coat, with the exception of No. 257, which appeared to be thriving satisfactorily. Although, as has been stated, No. 266 showed a more marked improvement than Nos. 259 and 265, as a whole the members of Group II appeared to be somewhat better in condition than those of

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Group III. At the conclusion of the experiment the condition of the control animal No. 251 was so critical that it was considered advisable to administer to it a readily assimilable iron preparation as a curative. It was, therefore, given saccharated carbonate of iron—one teaspoonful daily for several weeks. This elicited an almost immediate response, and thereafter recovery was progressive.

While the experiment was in progress, the soil from different parts of the island was analysed at the Macaulay Institute for Soil Research. Two different types of soil were examined: one from the "non-pine," and the other from the "pine" area.

Soil from the "Non-pine" Area.—This was more or less uniform to a depth of nine inches, and was sampled to that depth (Appendix, Table C, Sample I). It was a fine sandy loam with a tendency to "crumb" or granular structure. The colour was dark-brown with a greyish tint, and occasional shell fragments were present. The grass roots penetrated through this to a considerable depth.

Soil from "Pine" Area.—In this case there was a marked difference in the appearance of the soil within the surface nine inches. It was therefore sampled in two parts: the surface three inches constituting one sample, and the underlying six inches the second sample (Appendix, Table C, Samples IIa and IIb). Sample IIa consisted of a light greyish-brown fine sand, with practically no structure, and with abundant shell fragments. It comprised the material in which the turf of grasses grew, and the roots were largely confined to this layer. Sample IIb was a yellowish-grey, fine sand with no structure, and with abundant shell fragments. There were occasional particles of organic matter, but not enough to darken even slightly the colour of the sand. The results of the soil analyses are given in Appendix, Table C.

It will be observed that although the soil from the Reef shows a high "loss on ignition," this does not represent a large content of organic matter. Most of the "loss on ignition" is due to driving off CO_2 from the large amount of calcium carbonate present, and Sample IIb, which has a "loss on ignition" of nearly 22 per cent., is practically pure shell sand. The "non-pine" soil (Sample I) has a much higher content of organic matter than even the surface three inches of the Reef soil. Furthermore, the organic matter in the former is much more decomposed and better incorporated in the soil, giving a kind of "crumb" structure and a slightly loamy texture. The Reef soil (both surface and sub-surface) shows an extremely high percentage of calcium, as was to be expected, since abundant shell fragments were obvious in the sample. On the other hand, this soil contains much less iron than the soil from the "non-pine" area. There is, however, an appreciable amount of iron even in the sample from the "pine" area, but the effect of the high content of calcium is to depress the availability of the other plant nutrients, so it is possible that the *difference* in the amount of

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iron actually available to plants in the two soils, and directly or indirectly available to animals, may be much greater than these analyses indicate. This matter is referred to in the discussion.

Discussion.

The results of this experiment show that those animals which received the iron and salt supplements, either with or without the addition of dicalcium phosphate, did not develop pine; and in those cases in which the condition was already existent at the commencement of the experiment, the animals were cured. All the animals so treated improved in physical condition in the course of the experiment, and a means whereby healthy animals can be reared on "pining" land has been demonstrated. Only one of the untreated animals developed marked symptoms of pine, but the majority of them were obviously ill-thriven. It may be assumed, however, that had it been possible to continue the experiment over a longer period, the difference between the treated and the untreated groups might have been more marked. Because of the fact that only two specimens of blood were taken from each animal—one at the beginning of the experiment and one at the end—it would be unwise to lay too great stress on the results of their analyses.

It was assumed at the outset that the animals were suffering primarily from an iron deficiency, and this suggested the inclusion of ferric oxide in the mineral ration. When, therefore, the physical improvement was noted, it was expected that the hæmoglobin would show a corresponding relationship. This was not found to be the case; but although the improvement in the condition of the animals was not reflected in an increase in the hæmoglobin, it would not be justifiable in these cases to infer that the iron was not the responsible factor. The metabolism of iron compounds in the animal organism is as yet imperfectly understood. The work of Warburg[11] has shown the importance of iron in facilitating oxidation processes. In the animal these changes take place in the tissue cells as distinct from the red blood corpuscles. Mörner[12] has shown that the muscle hæmoglobin is distinct from the blood hæmoglobin, but, of course, both contain iron. As the muscle pigment is fixed, an examination of the blood would give no indication of its amount. It is conceivable then that in the experimentally fed animals some of the iron which has been assimilated has been stored in the muscle, and has there acted as a catalyst. The possibility of some other heavy metal functioning as a catalyst cannot be overlooked. The ferric oxide which was supplied to the animals was a crude commercial preparation, and analysis showed it to contain in addition arsenic and copper. The effect of these metals in promoting the assimilation of iron has formed the basis of a large number of observations. While there are differences of opinion as to whether this property is shared by other heavy metals, there is general agreement that copper in infinitely small amounts aids in the assimilation of iron, and thus effects improvement in the physical condition of the animal. Not all workers in this field, however, have estimated the hæmoglobin in their experimental animals. Some

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have based their conclusions on the increase in the body weight, as compared with that of the controls. This raises the possibility that the improvement noted is really due to the presence of copper *per se* in the tissues, an aspect which would warrant further investigation. Cunningham[13] has recently shown the importance of copper in enabling the liver to utilise iron. The catalytic action of copper in *in vitro* procedures is of common knowledge, and it is possible that it may function similarly in the body in stimulating tissue activity.

If the condition of pine be due to a lack of iron, some evidence of this should be found in the affected area. As indicated earlier, the iron content of the pasture samples was not determined because of soil contamination. It will be seen from the analytical data of the soils, quoted in Appendix, Table C, that the iron content of the soil from the " pine " area is appreciably lower than that of the soil from the good area, but these are " total " figures, and there is no measure of the *availability* of this iron to the plant. There is the possibility that this *availability* is low in the " pine " area, and that the herbage, in consequence, obtains only a small amount of iron from the soil. Two possible factors might create this condition, *viz.* (*a*) the actual form in which the iron exists ; (*b*) the coincident presence of the very high proportion of lime in the soil of the affected area (*circ.* 26 per cent.).

An observation and hypothesis recently put forward by Askew and Rigg, of the Cawthron Institute, New Zealand, working on volcanic soils,[14] are of interest in this connection. In an investigation into the causal factors of bush sickness they found that, although the total amount of iron in the soil did not show much difference as between affected and non-affected areas, the amount available to the animal, if consumed direct, as measured by its solubility in 5 per cent. oxalic acid, was markedly less in the affected area. They refer to an experiment carried out by Gilruth[15] in which pasture was cut from the affected area and spread on soil in the non-affected area. Sheep brought from the affected area and fed on this grass did not develop bush sickness. They suggest, as interpretation of Gilruth's experiment, that the degree of availability of the iron in the soil to the animal, as distinct from the iron content of the pasture, may constitute the determining factor in the development of bush sickness.

The Tiree soils were examined at the Macaulay Institute on the lines followed by Rigg and Askew, *i.e.*, extraction with 5 per cent. oxalic acid (100 grms. soil, and 400 *c.c.* oxalic acid were used for each extraction). On account of the very large percentage of calcium carbonate in the soil from the " pine " area, this soil had to be extracted repeatedly with fresh quantities of acid, and in the first extractions no iron was obtained. In the later extractions small amounts of iron were removed. In the case of the soil from the " non-pine " area, iron was extracted from the beginning.

Extractions were also carried out with 0.15 per cent. hydrochloric acid (a figure corresponding to the acidity of the gastric juice of a sheep. One hundred grms. soil from the " pine " area were extracted with approximately sufficient acid

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to neutralise the carbonate in the soil, and the same amount of acid was used for the soil from the "non-pine" area. The amount of iron removed from the "pine" soil was 0.04 per cent., and from the "non-pine" soil 0.06 per cent., so that even allowing for the presence of sufficient acid to neutralise the carbonate, the amount of iron extracted is not great, and is decidedly less in the case of the "pine" soil than in the case of the other. From these results it would appear to be possible that the amount of iron in the soil available directly to the animal (in the presence of so large an amount of calcium carbonate) may be the limiting factor on the thriftless land. But while these speculative views must in the present state of knowledge remain undetermined, from this experiment there emerges the finding that stock can be continuously grazed on thriftless pastures without detriment, provided they receive a mineral supplement containing iron, and, further, that animals which are suffering from pine can be cured by the administration of this mineral.

Summary.

(1) The condition of pine in sheep and young cattle, as it occurs in Tiree, and its relationship to allied conditions in other parts of the world, is discussed.

(2) Details are given of a field experiment designed to determine the nature of the disease and means for its prevention and cure.

(3) The administration of crude ferric oxide, with or without the addition of dicalcium phosphate, appears to be of specific curative and preventive value in pine.

(4) It appears probable that the cause of pine is a deficiency of iron in the pasture and/or of "available" iron in the soil in the affected areas.

Appendix.

TABLE A.—ANALYSES OF GRASSES.

Individual Samples off Reef (Pine Area), March, 1930.

Sample No.	1	2	3	4	5
Dry Matter	100	100	100	100	100
Nitrogen	1.59	1.29	0.95	1.25	0.59
Total Ash	9.64	6.41	4.65	9.58	9.25
Soluble Ash (in hot HCl)	5.12	4.62	4.32	7.98	7.17
Lime (CaO)	1.98	1.55	1.23	4.08	0.99
Phosphoric Acid (P_2O_5)	0.39	0.38	0.17	0.42	0.27

Individual Samples off Raised Beach at Hylipol (non-affected Area), March, 1930.

Sample No.	1	2	3	4
Dry Matter	100	100	100	100
Nitrogen	1.59	1.28	1.24	1.85
Total Ash	11.28	10.82	7.72	12.31
Soluble Ash (in hot HCl)	3.96	4.52	2.84	4
Lime (CaO)	1.11	1.38	0.76	0.84
Phosphoric Acid (P_2O_5)	0.62	0.42	0.24	0.62

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TABLE B.— COMPOSITE SAMPLES.

	Off Reef (Pine Area)			Off Raised Beach at Hylipol (non-affected area)		
Sampling :	15.5.30	7.6.30	12.7.30	15.5.30	7.6.30	12.7.30
Dry Matter	100	100	100	100	100	100
Nitrogen	1.56	2.33	1.97	3.38	2.22	2.36
Total Ash	6.21	7.28	8.27	9.73	9.65	9.37
Soluble Ash	4.43	6.32	7.23	7.93	7.76	7.89
Lime (CaO)	1.34	1.46	1.88	0.93	1.16	1.53
Phosphoric Acid (P_2O_5)	0.33	0.49	0.50	0.94	0.71	0.59

TABLE C.—SOILS FROM TIREE.

I.—Soil from " non-pine " area to depth of 9 inches.

IIa.—Thin surface layer (0–3 inches depth) of soil on Reef (" pine " area).

IIb.—Sub-surface layer (3–9 inches depth) of soil on Reef.

	I	IIa	IIb
pH (air-dry sample)	7.62	7.53	8.05
Lime requirement (air-dry sample)	*Nil*	*Nil*	*Nil*
Moisture (air-dry sample)	3.45%	2.25%	0.71%
Loss on ignition (sample dried to 103° C.)	13.14	27.93	21.93
Material insoluble in HCl (sample dried to 103° C.)	84.65	46.63	43.28
Calcium (CaO) (sample dried to 103° C.)	1.69	24.71	28.90
Magnesium (MgO) (sample dried to 103° C)	0.51	0.75	1.02
Iron (Fe_2O_3) (sample dried to 103° C.)	1.47	0.65	0.84
Phosphate (P_2O_5) (sample dried to 103° C.)	0.30	0.23	0.15
Nitrogen (N_2) (sample dried to 103° C.)	0.49	0.44	0.14

(The above analyses were made on conc. HCl extracts of samples passing a 2mm. sieve, the official method of the Agricultural Education Association).

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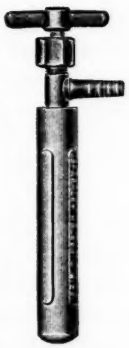
THE USE OF CARBON DIOXIDE AND BORAX SOLUTION AS A WOUND DRESSING.

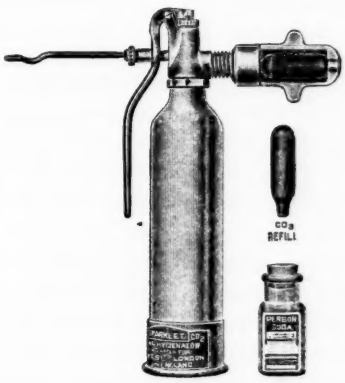
By J. McGUNN.

Professor in the Royal Veterinary College, London.

THE therapeutic uses of carbon dioxide have attracted much attention in medical circles in recent times. Its use as a respiratory stimulant is well known. The fact that it can be used with good effect in the treatment of wounds is worthy of our attention. For this purpose CO_2 is introduced into an antiseptic solution under pressure. The resulting liquid can then be readily sprayed on to a wounded surface or into a cavity. As the liquid is under considerable force, its action is two-fold, *i.e.*, antiseptic and mechanical.



The Sparklet
Portable "Resuscitator."



The Sparklet
"Hygienator."

The apparatus used is modelled on the plan of the soda syphon with which we were so familiar during the late War. The water of the soda syphons replace by a solution of sodium perborate (borax). When the CO_2 enters this fluid the resulting mixture consists of a solution of boric acid and H_2O_2 (hydrogen peroxide).

I have given this method of treatment considerable trial in both horses and dogs. Two cases of poll evil, one of fistulous withers, one of quittor, to say nothing of superficial and accidental wounds, have been treated, and in my opinion the healing processes have been considerably accelerated. For deep-seated sinus cases it is an invaluable aid. In the dog a number of cases of septic wounds resulting from accident or fighting have been subjected to this method of treatment with

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most gratifying results. Two cases, in greyhounds, of septic and multiple laceration as a result of fighting, reacted favourably in an almost astounding manner. As a mouth wash the spray is excellent.

A PRACTICAL METHOD TO SAVE MANY FOX PUPS.

By EARL F. GRAVES, B.Sc., D.V.M.

Fellow in Veterinary Science, College of Agriculture, University of Wisconsin, Madison, Wisconsin, U.S.A.

OBVIOUSLY it is of economic advantage to the veterinary profession to be able to assist fur growers with their many problems. Unless our advice and treatment do not produce favourable results the fur-farming industry will cease to be a potential client, and will seek assistance elsewhere. A very large number of questions asked by the fur farmers deal with management problems rather than disease, and practicable replies are necessary, based on observation and experiences not found in tests. It is well known that many vixens are " packers " or " luggers " as the ranchers often express it. Certain females bring the newly whelped young out of the nests and either bury them, leave them lying in the pen, or carry them about until the puppies succumb. On many ranches this is a serious problem, and at one time or another is the cause for loss on nearly every farm.

A very simple and useful device to put a stop to this carrying of pups may be easily made by any rancher. Simple as the method is, apparently it is not widely known, for each spring many fur growers ask me how to overcome this problem. A cage is made which fastens over the end of the nest or kennel chute. When a vixen is observed to be carrying her pups she may be run into the kennel, or the owner may wait until she returns of her own accord. The cage is then placed in position. When next the vixen emerges with a youngster she finds herself unable to go to any place, so will turn about a time or two and retreat to the next. She may do this several times before resigning herself to the fact that she must remain with the young. The cage may be left in place several days and removed. Should the animal resume the carrying, replace the cage; but if she has quieted down and shows no signs of packing the young, it may be left off. On a number of occasions I have left the cage in place for as long as thirty days. Usually only a rather short period is necessary. I have often resorted to this method, and have always found that it was 100 per cent. efficient. As a rule the mothers would make but a single attempt to carry the cubs after the cage had been placed over the mouth of the chute, they would return to the nest, place the puppies in it, and remain with them, and make excellent mothers. As a general thing the vixen will defæcate and urinate in the cage, and not soil the nest of kennel.

Any size cage may be constructed, but as it should be portable, I have found that dimensions of three or three and a-half feet long, by two or two and a-half feet wide, by about twenty inches in height, is sufficient. The frame may be constructed of any sort of wood and ordinary pen wire-netting used for covering it. Care should be taken not to construct the cage too flimsily, as it may be used season after season. The hinged door for placing food and water in the cage is most readily reached if it is placed on the top of the cage. This is a simple, useful bit of information which has saved many fox puppies on my own fox ranch, and many for my clients.

Clinical Articles

Intra-Thoracic Œsophageal Obstruction in the Dog: Presternal Œsophagotomy.

By J. G. WRIGHT, F.R.C.V.S.

Professor in Charge, Poor Out-Patients' Clinic, Royal Veterinary College, London.

THE frequency with which this condition is encountered prompts the writer to describe it in greater detail than was done in a previous communication to this journal (THE VETERINARY JOURNAL, June, 1929). It may occur in animals of all ages, and the cases under review have varied from twelve weeks to eight years old. It is more common in puppies, and is especially liable to occur when two animals are fed together. The foreign body causing the obstruction is almost invariably an irregular piece of bone. Smooth objects such as pebbles and balls appear to pass into the stomach without difficulty, although they may subsequently cause obstruction of the small intestine.

Mutton chops, the shoulder, neck and ribs, are the butcher's joints which give rise to the accident, for the pieces of bone usually comprise an epiphysis of a humerus or tibia, part of a vertebra, or the head of a rib. One one occasion a vertebra of a rabbit was encountered. This is a particularly dangerous object, for its sharp processes are liable to cause perforation of the œsophagus with a subsequent purulent pleurisy. One is impressed by the size of a piece of bone a dog will attempt to swallow. The specimen marked "A" in the photographic reproduction was removed from a twelve weeks' old puppy weighing 8 lb. The seat of the obstruction in the majority of cases is between the aorta and the diaphragm, although in one case it was opposite the second and third ribs.

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Diagnosis.—There may or may not be the positive history that the animal has swallowed a bone. This history, however, is so common, and is so frequently erroneous, that reliance cannot be placed upon it. The most prominent symptom is that an affected animal having swallowed solids is in considerable discomfort until regurgitation occurs. In order to satisfy oneself as to the correctness of this history the " meat test " should be carried out. The animal is offered (if it refuses to take them they are forcibly administered) a few pieces of cooked meat about the size of a hazel nut. Immediately there is salivation, followed by a succession of gulping movements in which the chin is drawn towards the presternal cartilage with tensing of the neck muscles. These symptoms are followed in a few minutes by regurgitation. This act may cause the animal to cry out in pain, whilst the regurgitated material may be tinged with blood. Liquids are usually retained, and one has met two cases in which obstruction has been present for at least a month, in which the animal has been kept alive by feeding on liquids only.

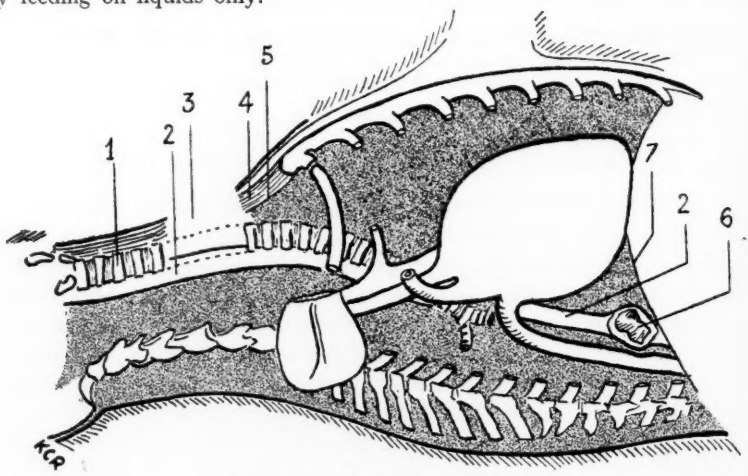
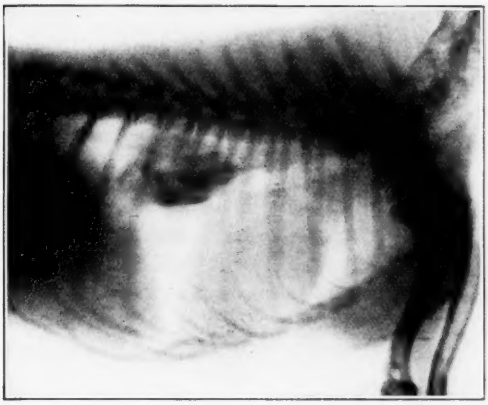


DIAGRAM OF STRUCTURES INVOLVED.

1—Trachea (portion omitted); 2—Œsophagus; 3—Site of incision; 4—M. Sterno cephalicus; 5—M. Sterno hyoideus; 6—Piece of bone obstructed in œsophagus; 7—Diaphragm.

On no account should any attempt be made to pass a sound or probang in the unanæsthetised animal, for the struggling such a procedure will provoke may prove fatal. If radiography is available the diagnosis can be readily confirmed.

It should, however, be noted that the administration of some radiopaque substance reduces the likelihood of error (½ to 1 oz. of a barium sulphate emulsion). The barium, held up on the foreign body, gives an unmistakable shadow at the site of obstruction. In cases where this aid has been neglected the radiograph



Seven-month-old Cairn Terrier. Obstruction four days' duration. Barium sulphate emulsion 1 oz.
(*Radiographers:* Ede & Firby)

Eight-year-old Fox Terrier. Obstruction one month. Barium sulphate 1 oz.
(*Radiographers:* Ede & Firby)

(Article by J. G. Wright, F.R.C.V.S., *page* 113)

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has left one uncertain, due to the fact that the agent causing the obstruction has comprised mainly cancellated bone and cartilage, and the shadow it has thrown has been a very light one.

In many cases a radiograph is not available, and other measures must be adopted to establish the diagnosis. The patient is deeply narcotised or anæsthetised, and a vulcanite sound of large diameter ($\frac{3}{8}$ to $\frac{1}{2}$ in.) passed down the œsophagus. A narrow sound or catheter may pass the obstruction and lead to confusion, whilst an expanding probang must never be used, as it is liable to become fixed beyond the piece of bone. The sound must be of sufficient length to pass well into the stomach in an unobstructed case, where it may be palpated through the abdominal wall.

Differential Diagnosis.—Constriction of the œsophagus in the dog, other than by or as the result of a foreign body, is rare. The œsophagus, and particularly the intra-thoracic portion of it, is not a common seat of new growth in this species (it might be noticed that it is in the cat). Furthermore, the condition under discussion is always of sudden onset, whereas pressure from without due to malignant disease of one or other of the thoracic organs, is of insidious onset.

Anæsthesia.—In cases in which the diagnosis has been positively established by radiography, it is our practice to anæsthetise the animal by the inhalation of chloroform or ether, or a succession of these, using a Hobday inhaler, without previous narcotisation. Atropine sulphate (grain 1/200 to 1/50) may be administered with advantage half an hour or so before operation, for it decreases salivation and reduces vagal irritability (the vagus being motor to the œsophagus and inhibitory to the heart). When it is necessary to carry out an œsophageal exploration to establish the diagnosis, it is best to first induce deep narcosis, using either nembutal intraperitoneally (grain one-fifth per 1 lb. bodyweight), or avertin rectally (c.c. 0.45 per kilogram bodyweight). Morphine should not be used. The violent vomiting which this drug provokes may prove fatal. General anæsthesia is finally induced by inhalation.

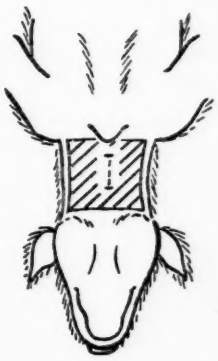

FIG. 1.

Operation.—The animal is restrained in the dorsal position, the operator's left hand being nearest to the animal's head as he faces the table. The fore limbs are drawn backwards, and the head and neck are fully extended, taking care that there shall be no deviation from the long axis of the body. This is necessary to ensure that the incision is made in the midline. The operation site, as outlined in Fig. 1, is clipped, shaved and disinfected with alcohol and weak solution of iodine.

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Having induced anæsthesia, a No. 10 gum-elastic catheter is passed down the œsophagus into the chest. The incision, ¾ to 1 in. in length, is made, its posterior commissure being about ½ in. in front of the manubrium sterni, through the skin, the sterno-cephalicus and sterno-hyoideus muscles, down to the trachea (Fig. 2). Provided the incision is made in the mid-line, hæmorrhage is negligible. The wound is opened by retractors or forceps. The œsophagus lies on the left of the trachea (that is, on the side of the wound distant from the operator) and deep to it. The index finger serves to separate the overlying muscles from the trachea down to the œsophagus, which can be readily recognised by the presence of the catheter in its lumen. The question arises as to the best method of withdrawal of the œsophagus out of the wound. Our practice is to grip it (including the catheter) lightly with a pair of fixation forceps (Fig. 3). If a tenaculum is used there is a danger of transfixing the œsophagus, or of injuring the vago-sympathetic trunk or carotid artery, which lie immediately beneath it. Having drawn the œsophagus up into the wound it is incised along its long axis about ¾ in., and the catheter withdrawn. The lips of the œsophageal wound are gripped with fixation forceps and held open by an assistant, whilst the operator, standing in front of the animal's head, introduces a long pair of forceps through the opening into the chest (Fig. 4).

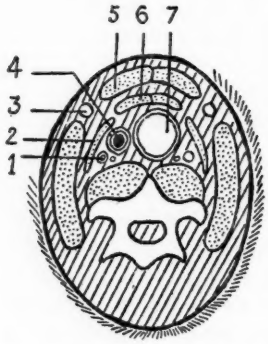

FIG. 2. 1—Carotid artery; 2—Œsophagus (catheter in lumen); 3—Jugular vein; 4—M. Omohyoideus; 5—M. Sterno cephalicus; 6—M. Sterno hyoideus; 7—Trachea.

The forceps which we adopt are the Hobday bitch whelping forceps. They have several advantages: firstly, they do not possess a ratchet; and, secondly, their structure is such that on opening them the space between the "eyes" forming the handle is practically the same as that at the jaws of the forceps. If forceps are used in which the joint is nearer the jaws than the handle, it may be impossible to open them sufficiently to grip the obstructing foreign body. The distance from the incision to the obstruction will vary according to the size of the dog. In puppies it is generally from five to six inches. In one case, the subject being an adult setter, the distance was approximately twelve inches. The piece of bone is gripped with the forceps and slowly withdrawn (Fig. 5). The greatest difficulty will be experienced drawing it past the aorta and through the first pair of ribs.

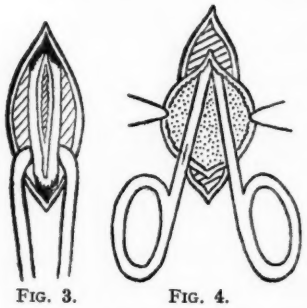

FIG. 3. FIG. 4.

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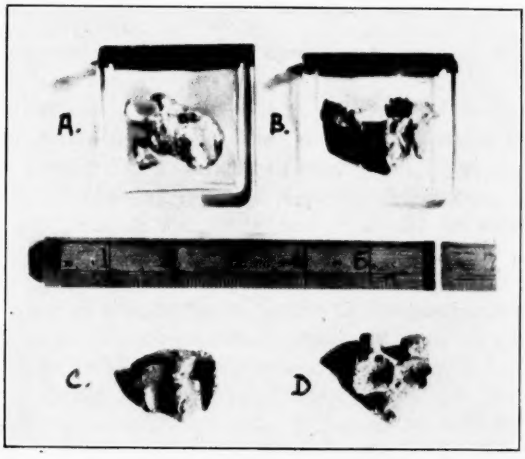

A, cervical vertebra, sheep. B, Dorsal vertebra, sheep (radiograph 3). C, an unrecognised sheep bone (radiograph 2). D, Distal epiphysis femur, sheep (radiograph 1).

(Article by J. G. Wright, F.R.C.V.S., *page* 113)

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Having removed the foreign body the wound is mopped, and the œsophageal incision closed with sutures. In our early cases the practice was to close the œsophagus with a single continuous silk (No. 2) suture. Lately, however, with a view to reducing the size of the fistula, which persists for some days after the operation, to a minimum, the mucous membrane is first closed with a continuous suture, followed by a series of interrupted sutures in the musuclar coat. The skin and muscle wounds are left open to ensure free drainage.

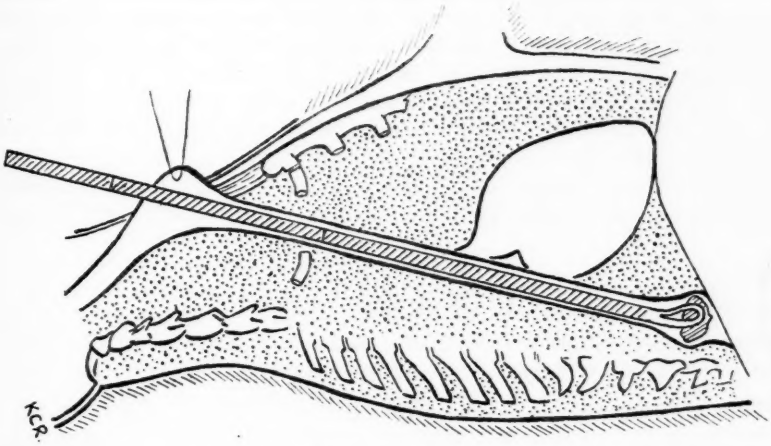

FIG. 5. Forceps introduced into œsophagus through presternal incision.

After-Treatment.—Food and water is best withheld for forty-eight hours after operation, but rectal injections of 5 per cent. sugar solution at body temperature should be given. The subcutaneous injection of 5 per cent. glucose in sterile normal saline (40 to 50 c.c.) may be given with advantage. The wound often suppurates for three or four days, and it should be treated with a solution of hydrogen peroxide (25 per cent.) or eusol. A fistula may persist for four to eight days after operation, after which it becomes occluded by granulation. After forty-eight hours, feeding by the mouth should be commenced, and we find meat jelly the most easily swallowed. During the persistence of the fistula care must be taken that the animal is getting sufficient water, and if it escapes, water should be administered either rectally or subcutaneously. The length of time the fistula persists varies. In puppies the wound may entirely close in forty-eight hours; in older animals it usually persists for from five to eight days. A case in which a permanent fistula occurred has not been met.

Prognosis.—Prognosis is good. In some of our cases in which the obstruction has been present for a month prior to our being consulted, the animal has been markedly emaciated due to lack of food, and yet recovery after operation has been

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uneventful. In a series of eighteen cases, four have been unsuccessful. Details of these are as follows:

(1) Four-year-old Cairn bitch. Obstruction four days' duration. Morphine sulphate, grain ½, given for examination. The drug provoked violent emesis, causing the animal to collapse and die from syncope. (2) Twelve-month-old Aberdeen bitch. Obstruction seven days' duration. (This case was attended in consultation with Major G. E. Henson, Bristol.) The operation was successful, but the animal was destroyed twenty-two days later because a stricture had developed at the seat of obstruction. (3) Eight-year-old smooth terrier bitch. Obstruction of one month. (Case seen in consultation with Mr. Charles Roberts, Tunbridge Wells.) The operation was apparently successful, but the animal died in a convulsion three weeks later. The cause of death is not known. (4) Fifteen-months male Cairn terrier (attended in consultation with Mr. E. R. Ambrose). Obstruction of six days' duration. Immediate result of operation successful. Death occurred six weeks later due to a purulent mediastinitis and pleuritis, due to a small laceration of the œsophagus at the seat of obstruction.

A Cæsarean Section.

By JOHN HOBDAY, B.Sc., M.R.C.V.S., and THOMAS STOBO, M.R.C.V.S.
Weybridge.

A THREE-YEAR-OLD miniature dachshund bitch at sixty-fifth day after service. Owner states that bitch had produced one puppy without difficulty six months previously, whilst in quarantine. Examination reveals the forelegs of a puppy in the vagina, which is very small. No head is palpable. Forced traction first by the fingers, and then by forceps, fails to reduce the dystokia or bring the head of the fœtus further forward. The puppy is pushed back into the body of the uterus with the intention of crushing the head if able to locate it. Examination, however, now reveals a tear in the roof of the vagina through which the rectum can be felt, no doubt the result of the traction forcing the pup against the roof of the pelvis. Laparotomy performed three-quarters of an hour later. Nembutal, gr. 1½; weight of bitch with pups (estimated three) 11 lb. Anæsthesia supplemented by chloroform.

Incision releases a quantity of green fluid from the abdomen. Two pups in fœtal membranes are found free in the abdominal cavity and removed, one remaining *in utero*. The tear in the roof of the vagina is about 1½ in. long, and is slightly enlarged forwards, and the third puppy is worked backwards from the left horn and extracted. Its membranes remain inside, but are removed after a little manipulation by the fingers. This puppy is alive, and is placed temporarily in warm wool. The incision in the uterus and vagina is now stitched by continuous suture and oversewn from the anterior end as far back as possible. The

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abdomen is well swabbed out and sutured up. Recovery uneventful. Healing by first intention.

(The puppy was successfully fostered by a "disappointed" Airedale bitch which had just lost her pups at whelping.)

Mercurochrome 220.

By J. DOWLING ALLMAN, M.P.S.

THERE are certain substances which are employed by surgeons and veterinarians to decrease the activity or destroy germs and their spores, such substances are known as germicides, and it is this chemical compound, Mercurochrome 220, that is now under consideration. It is a synthetically prepared substance by the substitution of mercury with aniline dye, and is chemically dibrom. oxymercury-fluorescin. Full particulars of this compound are recorded by Young, White, and Swartz (*J. Amer. Med. Assoc.*, 1919, p. 73), and has been extensively employed in America as a germicide. It occurs in green scales or granules, freely soluble in water. The solution has one disadvantage—that it stains the skin a bright-red colour, but the stain is readily removed by rubbing first a 2 per cent. solution of permanganate potash, and then a 2 per cent. solution of oxalic acid. Let us now consider to what use the compound can be introduced into veterinary practice. Judging from clinical reports it should be placed amongst the list of germicides.

As a germicide, a 25 per cent. solution should be a useful agent in the treatment of imflammatory conditions of the legs of horses commonly known as "grease," and applied as a wash, or by means of a spray; and to arrest synovial discharges, foul ulcers, and ill-conditioned wounds, a 10 per cent. may be used. In canine practice a 2 per cent. solution dropped into the ear will be found an excellent remedy for otorrhœa and canker of the middle ear; and 1 per cent. solution as a disinfectant and soothing eye-wash in conjunctival inflammation and irritation.

It is well to bear in mind that there is a great deal of difference between antiseptics and germicides. An antiseptic arrests putrefaction—that is the growth of organisms, whereas a germicide is capable of killing disease germs and their spores, which are much more resistant than the bacteria of putrefaction: thus many agents, such as sulphate of zinc, carbolic acid, peroxide of hydrogen, formalin, even in strong solutions commonly used as antiseptics, do not destroy the spores of bacilli, and consequently are not germicides. Mercurochrome has attained a high reputation in medical practice, but the compound belongs more to the domain of the surgeon than the physician. It is used and commended by ophthalmic surgeons, and is considered a more effective remedy than nitrate silver in the treatment of that frightful malady, ophthalmia neonatorum. As a bladder wash, a 1 per cent. solution is very effective in chronic pyelitis, chronic cystitis, and gleet. In pathological diseases of the tongue and mouth a 3 per cent. solution has been used with some cures. Dr. P. Bonsfield (*The Lancet*,

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1928, p. 214) has successfully eliminated the Klebs Löffler bacillus from the throat of two diphtheria carriers, by spraying the throat with a 5 per cent. solution from an atomiser, and then swabbing out the throat with the same solution. The solutions to be effective must be freshly prepared, and with distilled water.

A "Tapeworm" Story.

By WM. WRIGHT, M.R.C.V.S.
Torquay.

A CLIENT writes to me as follows:—

Two or three weeks ago I had a nice mid-cut cod, about 3 lb., stuffed, tied up, and baked for dinner. Self and Kitchen. That is the preface.

About a week afterwards when out with the dogs in the field I saw one of my old English sheep dogs in difficulties. She was about 100 yards away, and as she did not come, I went towards her to see what was wrong. Then I saw what looked like a huge bunch of tape worms protruding and training on the ground. I was horrified, but closer inspection soon relieved that, when I discovered *tape* all right, but not any known variety of *worm*. What had happened was this: The bitch, "seeking what she might devour" at the rubbish heap a few days previously, had found the tape nice and fishy, ½ in. wide and 1½ yards long, which had been used to bind up the stuffed piece of cod; and which instead of being put on the kitchen fire had fallen in the ash-box and gone out unburnt.

The tape all came away quite easily.

Abstracts of Current Literature

The Poisoning of Horses by the Common Bracken (Pteris aquilina L.).

By S. HADWEN, D.V.Sc., *Pathologist, Veterinary Research Laboratory, Agassiz, B.C.*; and E. A. BRUCE, V.S., *Assistant, Veterinary Research Laboratory, Agassiz, B.C. Department of Agriculture, Canada (Health of Animals Branch).*

A DISEASE known locally as staggers has been prevalent on the Pacific slope for many years. It is characterised by uncertain gait, loss of equilibrium, general unthriftiness and unimpaired appetite. The greatest number of cases occur during the winter months, the disease being most common when the weather is severe and protracted. Treatment if instituted early is usually successful, but neglected animals generally die.

On all the farms where cases occurred, bracken (*Pteris aquilina L.*) was found in the hay. While it was thought that bracken might be the cause of the trouble, very little literature could be found on the subject. Various authorities have mentioned that the plant was suspected of being poisonous, but do not support

their statement by any experimental evidence. The best description of bracken poisoning is given by Lander, in his book on toxicology, *i.e.*, " The poisoning of horses after prolonged feeding on bracken along with other forage is mentioned by the German authorities." Poisoning is thought to be due to the effects of an acid (pteritannic acid) similar to, and possibly identical with, filicic acid of male-fern. Bracken poisoning of the horse does not appear to have been reported in Great Britain, but quite recently we were advised by a returned army veterinarian (L. D. Swenerton) that he had seen some cases in the South of England that had been fed on ferny hay from Northumberland ; at the time, however, he did not connect the bracken with the trouble, as at that time he had not seen our preliminary communication. In 1909–1910, the British Board of Agriculture investigated a somewhat obscure disorder that occurred in cattle in the early autumn (August-November), after eating bracken. This investigation was confined to cattle, and the results obtained show no similarity to the disease with which we are dealing ; this may be due to the fact that green bracken was used, their findings, however, were inconclusive. We have never seen cattle or horses eat green bracken unless starved to it.

We have evidence that the disease occurs in Washington and Oregon, as well as in British Columbia, and in view of the fact that *Pteris aquilina* has a very wide distribution, it seems probable that the fern causes trouble elsewhere. During the hard winter of 1915–1916, the mortality amongst horses in the Fraser Valley and on Vancouver Island was very heavy. As an extreme instance we cite the following : In the little village of St. Elmo, B.C., out of twenty-four horses owned by eleven farmers, sixteen died of bracken poisoning, four recovered, and the balance (four) did not take the disease. To determine definitely whether bracken was the cause of the disease, known locally as staggers, or not, it was decided to conduct some experiments. Permission was obtained from the Veterinary Director-General to buy the necessary animals and incriminated feed. As the disease has only been reported when horses have been confined, it was decided to simulate in so far as possible the conditions under which animals became affected. It was commonly believed by the majority of people that cold weather was partly responsible for the disorder, but the only bearing such has on the case is that during cold weather the animals get little or no exercise, and are not able to supplement their food by picking grass or other green food. The horses attacked are usually those that receive the minimum amount of care, but well-cared-for greedy horses may contract the disease through eating their bedding, which often consists of bracken that has been left in their mangers.

Notes on Experiment No. 1.

Two aged horses were procured, and a supply of hay that carried about 20 per cent. bracken. One horse was fed the hay after all fern had been picked out of it, the other animal received the same hay plus the fern. Average daily feed : control horse twenty-four pounds of clean hay ; experimental horse seventeen

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pounds of hay and seven pounds of bracken. No other food was given either animal. Both horses were kept in box stalls and allowed no exercise.

April 1st, feeding commenced; 24th, fern horse breathing hard, seems to drag his legs; 29th, fern horse shows slight signs of intoxication; 30th, fern horse shows undoubted signs of intoxication. May 1st, fern horse intoxicated, nearly fell when made to get over in his stall. May 2nd, fern horse much worse, was found down at 6.45 a.m., and could not be made to stand. Towards evening he showed a full soft pulse. Struggled now and then. Moved the legs continuously; looked completely intoxicated. Pupils slightly dilated. May 3rd.—Fern horse, pulse sixty-four. Animal weak and had nervous spells; trembling; eats and drinks well; distinctly intoxicated; does not struggle; fæces loose. May 4th: Fern horse much weaker; pulse eighty. Nervous spells more frequent. Animal so weak it can hardly get up on its sternum. At night was unable to raise its head off the ground, and though it could not masticate, would grasp food between its teeth. Continually twitching. Blood taken coagulated in ten minutes; serum clear and yellow. May 5th: Fern horse very weak. Still having nervous spells. The head was drawn in to the neck; the feet, which were on the upper side, would stand out stiff; the back would arch, and all the muscles became tense. As soon as an attack was over the muscles relaxed and the animal breathed heavily until restored. As the horse was battering himself about badly and was clearly dying, the carotid was severed and the animal bled to death.

Autopsy.—The stomach contained about two quarts of a sticky, light olive-green liquid, which proved to contain bile by Gemlin's test. There were some red spots at the junction of the cardiac mucous membrane. The small intestines were empty, much wrinkled, and covered with a greenish-yellow mucus. The large intestines contained some well-chewed food. All the other organs were normal except the kidneys, which appeared congested in the cortical portion. The brain also appeared congested. The blood clotted normally. During the whole period of feeding temperatures were taken morning and evening; these proved to be normal.

The control horse that was fed on the hay out of which the fern had been picked showed absolutely no ill effects.

Notes on Experiment No. 2.

As in the preceding experiment, two horses were procured (one having served as control in Experiment No. 1), and a quantity of hay that carried a high percentage of bracken. One animal received the hay after the fern had been picked out of it; the other received the same hay plus the fern. Average daily feed; control horse, twenty-four pounds of clean hay; experimental horse, thirteen pounds of hay and eleven pounds of fern. Both horses were kept in adjacent box stalls and allowed no exercise.

June 1st: Feeding commenced. June 23rd: Supply of fern ran out, had to resort to cutting and drying freshly-cut bracken, which could not be properly

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cured owing to continued wet weather. June 24th: A small amount of hay was received that contained a little bracken. It was not until July 6th, however, that a sufficient supply of dried fern could be obtained; then, from June 23rd until July 6th, the material fed was a poorly-cured sample. June 29th: Fern horse shows yellowish-red conjunctivæ. July 1st: A careless attendant was caught giving the fern horse green clover; this, coming on top of our difficulty in procuring properly dried bracken, did not look any too hopeful for our experiment. July 8th: Fern horse was noticed to be staggering badly. When the head was raised the animal was inclined to fall. July 9th: Fern horse worse. Pulse soft and weak, forty per minute. The urine was examined and found to contain no albumen nor sugar. July 10th: Fern horse progressively weaker. Shows distinct signs of intoxication. The eye has an intoxicated look. When the animal is pushed it sways to and fro. Appetite unimpaired. July 11th: Fern horse about the same. Pulse forty-two, and weak. Intoxication marked. July 12th: Fern horse was found down in the morning, but was helped up. Pulse fifty-nine, weak and irregular. Respirations forty-seven per minute. Pupils slightly dilated. When head was raised a few inches the animal nearly fell. July 13th: Fern horse pulse fifty-five, weak and irregular. Head carried low. July 14th: Fern horse pulse same as yesterday. Pupils more dilated. Head carried very low. July 15th: The fern horse went down between 7 and 8 a.m., and could not be made to stand. Animal has nervous spells, twitching of the muscles, more especially of the face. Animal getting badly bruised. July 16th: Fern horse battered up badly. Pulse seventy-two and weak. Visible m.ms yellowish-red. Temperature 99.5. As the animal was moribund, the carotid was severed at 11.7 a.m. Blood taken at 11.9 a.m. had set by noon (when it was first noticed).

Autopsy.—General condition emaciated. Lungs normal but for some emphysema of long standing. Trachea and bronchi congested. Heart normal. Kidneys, cortex congested. Bladder normal. Spleen normal but for some old adhesions. Liver contained a few chalky deposits (degenerated parasites), and was congested. The duodenum contained bile and thick frothy mucous. The large intestines were normal. The most noticeable changes were found in the stomach, brain and spinal cord. The brain and cord were greatly congested. The stomach contained about a gallon of gelatinous fluid which contained blood and mucin; no bile could be demonstrated. The whole surface was covered with a sticky mucus which held minute particles of bracken. The villous mucous membrane was greatly swollen and congested. During the experiment temperatures were taken twice a day; no abnormal temperatures were recorded.

The control horse showed no ill effects from eating the hay out of which the fern had been picked.

Notes on Experiment No. 3.

The subject in this experiment was the horse that had served as control in the two previous experiments. The animal was confined, as were the former subjects, and was fed ferny hay just as it was received. The hay was found to contain

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29 per cent. bracken. The approximate daily feed was 20¼ lb., of this bracken composed about 5¾ lb.

October 27th: Feeding commenced. November 25th: Up to this time the animal laid down at night; 26th, did not lie down during the night; 27th, did not lie down during the night; 28th, animal went down at 3.15 p.m., was helped to rise; temperature 99.8; 29th, animal down and cannot rise; tetanic spasms, the head being drawn back; pulse seventy-six, fairly strong; temperature 97.4; 30th, animal much the same as yesterday; temperature 100.3. December 1st, animal not so violent as former subjects, otherwise much the same; pulse eighty and weak; temperature 99.5, a.m., 100.9, p.m.; 2nd, animal found dead in the morning.

Autopsy.—Blood dark. Liver and kidneys engorged. Clots in heart. Lungs and spleen normal. Stomach contained dry ingesta and was distended with gas. At the cardiac end the mucous membrane was lined and crevassed; at the junction of the pyloric portion there was a deep erosion, and under this was a gelatinous infiltration. The bottom of the crevasses was red, giving a raw-looking appearance. The duodenum was covered with a slimy, thick mucus of a greenish-yellow colour, and had reddened areas. In the ilium the catarrhal exudate was of a greyish colour. The large intestines were more or less empty. The bladder was full of urine, faintly alkaline, and containing albumin. The brain was congested, and there were well-marked hæmorrhagic areas under the pia-mater of the cord. During the experiment temperatures were taken twice a day; no abnormal temperatures were recorded. The hay fed to this animal was weighed carefully at each feeding; the total amount consumed was 670 pounds, of which about 29 per cent. was bracken; the amount of fern fed was therefore 194.3 pounds.

Notes on Experiment No. 4.

The subject in this experiment was a strong, healthy gelding. The amount of hay and bracken fed was as follows: From March 13th to April 2nd: Fed 290.5 pounds of hay and 93.5 pounds of fern; daily feed of fern equals 4.4 pounds. From April 3rd to April 23rd: Fed 406.4 pounds of hay and 51.6 pounds of fern; daily feed of fern equals 2.4 pounds. From April 24th to May 23rd: Fed 333 pounds of hay and 202 pounds of fern; daily feed of fern equals 6.9 pounds. May 19th, up to this date the animal appeared normal; 20th, conjunctivæ yellowish-red, shows slight symptoms; 21st, abdominal breathing noticed, pulse 24; 22nd, staggering, eyes have staring look, conjunctivæ yellowish-red, not feeding well; 23rd, animal off feed and staggering badly, temperature 99.4, pulse 26; 24th, animal quite intoxicated, pulse 32; 25th, staggering badly, fell down, but got up, was turned out into yard, temperature 99.4, pulse 40; 26th, staggering badly, animal killed.

Autopsy.—Carcase in fair condition. Icterus. Liver congested. Lungs emphysematous. All other organs normal, with the following exceptions: Brain greatly congested, the convolutions being sharply defined on section.

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Cord congested. Stomach regurgitation, of food, small amount of bile present; cardiac portion showed some old eroded patches, pyloric portion showed reddened areas with small hæmorrhages. Small intestines bile-stained and empty except for a slimy yellowish-green mucus, some of which was in clots. Bladder full of urine, no albumin or sugar present.

Summary of Experiments.

The foregoing experiments indicate the cause of " staggers " in horses to be due to the ingestion of dried bracken over a certain period and under certain conditions. No toxic properties can be attributed to the hay, as an animal fed on hay out of which the fern had been picked remained absolutely normal. Of the four animals that developed the disease, one showed symptoms on the twenty-fourth day, and was dying on the thirty-fifth day, when it was put out of its misery. The second horse did not show marked symptoms until the thirty-eighth day, and was dying on the forty-sixth day, when it was killed. The length of time it took the second horse to develop symptoms as compared with the first, was no doubt due to the fact that for about twelve days properly dried bracken could not be procured, and also to the mistaken kindness of a careless attendant who was caught giving the animal green clover. The third horse, which had served as control in the two preceding experiments, was fed on hay exactly as received from a local source. The hay carried 29 per cent. bracken, and caused the death of the animal in thirty-six days. The fourth experiment was somewhat different to the others: this animal was fed 4.4 pounds of fern per day for three weeks, and was then reduced to 2.4 pounds per day for a further three weeks with no apparent ill resulting. Upon increasing the daily feed of fern to 6.9 pounds, definite symptoms of the disease were noticed on the 29th day (after this increase), and the animal was killed on the thirty-fifth day. Judging from the foregoing, it can be assumed that an addition to the daily diet of about six pounds of dried bracken will kill a horse in about one month.

Pathological Findings.—The brain and cord showed marked congestion. No bacteria were found either in their substance or fluids. The stomach is the organ chiefly attacked, as would be expected from the nature of the food, which is highly acid. The pyloric end shows the greatest change; the m.ms. have a mottled appearance and bile-stained, and in some places there are bleeding eroded areas. Emphysema of the lung has been noted, and congestion of the liver. The blood was normal, no bacteria were found, and there was no variation in the percentages of the different leucocytes.

Summary.

In *The American Journal of Veterinary Medicine*, L. H. Pammel, of the Iowa State College, reviewed a preliminary communication made by us before the British Columbia Veterinary Association at Vancouver, B.C. In view of Dr.

Pannel's well-known association with poisonous plants, it may be of interest to quote his words, *viz.*: "The bracken is an extremely common plant along the entire Pacific coast, especially in Oregon and Washington, and from British Columbia to Alaska. The experiments seem to show that the bracken is poisonous. This fern, like many others related to it, has been regarded as poisonous. However, there are few definite facts on the nature of the poisoning. Many, if not all, of the ferns contain filicic acid and a fixed poisonous oil. In this case, as in others, we need some careful chemical investigations to prove the poisonous nature of the plant. We hope that this investigation will be forthcoming."

While up to the present we have not had any satisfactory analyses made, the physiological experiments cannot be gainsaid, and, further, we drew attention to the fact that on all farms visited by us where the disease existed, bracken was present in the hay. That the toxic principle is insoluble in water has been established, as in addition to the feeding experiments already mentioned, a watery extract was prepared, and administered to a horse twice a day for some sixty-four days. This extract was concentrated down until one cubic centimetre was approximately equivalent to one gramme of the dried fern. The usual daily dose was two thousand c.c., but one day as high as five thousand five hundred c.c. was administered. In all the animal received the equivalent of about two hundred and ninety pounds of fern, during which time he was only fed clean hay, and was not allowed any exercise. No symptoms of bracken poisoning were noted, notwithstanding the fact that this animal had consumed, in the form of an extract, one hundred pounds more than the amount of dried fern necessary to kill experimental horse No. 3.

The disease as it occurs on the average farm in British Columbia is brought about in the following manner: Bracken (*Pteris aquilina L.*) is found in a large amount of the hay grown in the lower parts of the province, especially so on newly-cleared or poorly-worked farms, and it is on such farms that the disease is most common. During the severe weather the animals are confined for a long period, and none too liberal an allowance of hay given each animal, the result being that horses that otherwise would leave the bracken in their mangers are forced to eat it. (We have never seen an animal eat green bracken, and as a general rule horses do not eat dried bracken unless forced to, except greedy horses that eat their bedding, which often consists of fern rejected out of their hay.) The affected horses in nearly all cases received but little else than hay in the shape of food; where animals were given plenty of hay and roots, with occasional feeds of bran and oats, no trouble of this nature occurred. In this connection it may be remarked that no cases were reported in the city stables. While it is evident that a small amount of bracken can be eaten with impunity, large amounts coupled with unhygienic surroundings and lack of variety in diet will bring on the trouble. Though the cause of this disease had not been definitely established heretofore, veterinarians have been quite successful in treating the malady if

they were called early enough, and when at all possible farmers are strongly advised to summon such professional aid as is available.

Symptoms.—Usually the first indication of trouble noticed by the owner is an unsteady gait upon taking the animal out to water. The appetite is usually good. Animal inclined to constipation. Eye congested. Flanks tucked up. Nervousness. In the later stages, if the head is raised the horse may fall. Stands with the legs spread and has a distinctly intoxicated look. Greedy horses are most liable to attack.

Treatment.—The treatment recommended by Dr. S. F. Tolmie, of Victoria, B.C., who has had a great deal of experience with such cases, is as follows: Remove all ferny hay and bedding. Administer a good brisk purgative, such as Barbados aloes, seven drachms; calomel, one drachm; and ginger, one drachm. Half-ounce doses of potassium bromide twice a day in the feed or drinking water. One to two drachms of potassium iodide three times a day is recommended. Give medicine in the feed or drinking water, or with a syringe. Feed laxative food such as bran mash and carrots. Give enemas if necessary. When animal is very groggy place in slings with extreme care, avoiding excitement as much as possible. Tie with guy ropes on both sides, in front and behind. Slings should be applied so that the belt presses lightly on the abdomen when the animal is standing erect, but so that on the least flexion of the joints support will be given. In some cases cold packs to the head are recommended. Recovery after this form of treatment is the rule, but if begun too late losses will occur. Care is needed in giving medicines to avoid unnecessary excitement, as rough handling will invariably aggravate the symptoms.

To the farmer who is unable to secure professional aid we would suggest the following treatment: First remove all ferny hay and bedding. Give a quart of raw linseed oil, taking especial care that none falls into the lungs. Give good clean hay, warm bran mashes and roots. The horse should be kept as quiet as possible owing to its nervous excitability. Warmth is of aid in combating the affection, whilst a cold draughty stable tends to lower the vitality.

The Eradication of Bracken.—We have taken some pains to find out if there was any bulletin or other information on this subject. The only bulletin we can find dealing with this matter is one written by H. R. Cox, of the United States Department of Agriculture, entitled, "Eradication of ferns from pasture lands in the Eastern United States" (*Farmers' Bulletin*, 687). He recommends methods which can be used in the Eastern States, and says that the Department of Agriculture has not investigated the fern problem in the West. Various methods have been tried, but the two that have given the best success are spraying with solutions of salt and cutting. Two treatments a year, either spraying or cutting, are advised. The best time to treat ferns is stated to be just before sporing, or about the middle of June and the middle of August. Cutting is somewhat cheaper than spraying.

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In the East, with ferns at an average thickness in a pasture a man ought to cover about 2½ acres a day ; in the West, where the ferns grow much more vigorously, the labour entailed would be greater. Probably the best method for the West would be a combination of cutting and choking out the fern with red clover, as a good stand of clover tends to weaken the fern. Since bracken has now been definitely proved to cause poisoning in horses, we would urge all farmers to make determined efforts to get rid of the plant, and to keep all fodder containing it away from their horse stables, even in the shape of bedding.

Acknowledgments.—We beg to acknowledge the valuable information given by Drs. Tolmie and Derby, especially as regards statistics and treatment of the affection. To Dr. F. Torrance, Veterinary Director-General, we owe thanks for his interest in our investigation.

Ulcerous Dermatitis of Ruminants and its Relation to Human Diphtheria.

MATTEO CARPANO, writing in the *Bulletin of the Serotherapeutic Institute* of Milan, for July, 1931, and the author of a pamphlet of thirty-two pages, with four photographic plates, has the following :

The affection was observed for the first time twenty-five years ago in cattle and sheep in Erythria ; then, in 1914, in Lybia, in sheep affected with foot-rot. It was studied in Egypt, where cattle and buffaloes were affected. The dermatitis shows as hard nodules, a little painful on pressure, situated in the thickness of the skin, of the volume of a haricot bean to a nut. Usually it appears on the shoulder, neck, croup, back and sides, the upper part of the limbs, and the mammæ. The nodule persists without modification for some time, and resembles the lesions of hypodermosis without the presence of the orifice. Later the epidermis macerates, a transudate appears which glues the hair and forms scabs. Sometimes more or less extensive ulceration appears, or an abscess with abundant pus. Scabs falling off leave violet pits. In young subjects the malady causes nutrition defects, and even death. The affection is due to a corynebacterium which, by its morphological, cultural, and biologic characters, is identical with the Klebs-Löffler bacillus of diphtheria. Like that of diphtheria, the germ isolated gives a very active exotoxin, and the tests of immunity, active and passive, show that the two microbes have identical antigenic power. It is, therefore, established that there may exist in ruminants a malady naturally directly due to a *C. diphtheriæ*. These animals, besides their direct connection with man, being producers of milk, and thus constituting an excellent culture media, one can stress the danger which such an infection can carry for man, and, above all, children. Ruminants affected with ulcerous dermatitis ought to be considered veritable reservoirs of the virus of diphtheria, and capable of transmitting contagion direct or through the milk.

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The Uselessness of the Sterilisation of the Flesh of Tuberculous Animals Used for Slaughter ; being a Vindication of the Theory of Robert Koch, as propounded at the London Tuberculosis Congress in 1901. By Prof. Dr. MAX MÜLLER, Munich. *Deutsche Schlachthof-Zeitung*, December 25th, 1932.

EVEN though Robert Koch's assertion that the flesh of tuberculous animals was harmless came as a surprise to those present at the London Congress, and to many learned representatives of the scientific world, it nevertheless contained nothing basically new. It repeated the belief generally prevalent since the end of the eighteenth century, that the flesh of tuberculous animals is not harmful to human beings. This had been accepted by inspectors of meat until the German law regarding the inspection of the flesh of slaughtered beasts came into force on June 3rd, 1900.

Science had indeed begun to adopt a different attitude with regard to the harmlessness of tuberculous animals ever since, in 1865, Villemin had established the fact that tuberculosis in human beings and animals is an inoculable disease capable of transference from man to animal, and from animal to animal. In Germany also, Gerlach in particular had proved the identity of the two diseases by means of his experiments on animals. Robert Koch's discovery, in the year 1882, of the similarity throughout the stages of the disease of the tubercle bacilli of both human beings and animals supported the Villemin-Gerlach view. As, from the Congress of 1822 onwards, the danger of the flesh of tuberculous animals was repeatedly asserted, and thus caused measures to be taken by sanitary authorities to avert the danger to human beings arising from the flesh of such beasts —the steps taken being at first urgent and then more moderate—it must have come as a great surprise when, in one of his early addresses, R. Koch, in 1901, expressed the opposite opinion, without however being able to produce any conclusive evidence.

Even though H. Selter and W. Blumenberg, in the third edition of the " Handbook of Pathogenetic Micro-organisms," by Kolle, Kraus, Uhlenhuth, Vol. 5, page 763, state, in support of Robert Koch's view, that tuberculous flesh is only very slightly pathogenetic for human beings, still to-day no basic proof has been brought forward. On the other hand, however, I must assert that this does not prove that the statement of Robert Koch regarding the harmlessness of the flesh of tuberculous animals is incorrect. The determination of the presence of bovine tubercle bacilli in human beings weighed the balances more against Koch than in favour of his theory. But no connection has been established between these findings in the case of human beings and the flesh of tuberculous animals. The question whether the flesh of such animals is dangerous or not must be decided, not by the study of types, but by the examination of tuberculous animals in conjunction with the definite and conclusive study of the manner of propagation of tuberculous infection in the animal carcase. During the years 1912 to 1914 I was occupied with experiments to prove the truth of the Robert Koch theory, and

worked at the Munich abattoir in company with Ishiwara, Mittel, Haeutle, Leonpacher, and Siebinger, and the results of many series of experiments are given below in comprehensive form. A detailed report on the results of these experiments is also given in the *Zentralblatt für Bakteriologie*. On the other hand, there are those authors who, on the basis of the Johne-Ostertag blood-infection theory, still attempt to support the view that the flesh of tuberculous animals is harmful owing to the existence, or the supposed existence, of a tuberculous blood infection. Owing to this, as well as to the manner in which the authorities cling to the Johne-Ostertag blood-infection theory when regulating the inspection of meat, it has not been possible, up to the present, to alter the attitude towards the inspection of the meat of tuberculous beasts in accordance with the fundamentally correct theory of R. Koch. The unprejudiced examination of the question has been hindered by many difficulties arising from the fact that since the year 1865, problems of an economic, hygienic, pathological-anatomical and bacteriological nature have been thoroughly confused. A disentanglement of these questions is still being attempted, but Robert Koch's theory, as expounded in London in 1901, was not able to separate these two viewpoints regarding the meat question to any extent. My statements will therefore help to clear up the matter.

We must start from the fact that until the German law dealing with the inspection of animals for slaughter came into force, on April 1st, 1903, a two-fold attitude regarding the inspection of the flesh of tuberculous animals was in existence. On the other hand, the opinion had been held in country districts since 1785 that it was not dangerous, and on the other, it was held on the grounds of the Johne theory, dating from 1886, that the flesh was dangerous. This idea has entrenched itself more and more in the slaughter-houses, and has become generally accepted owing to the introduction in a mild form of laws governing the inspection of meat. At the same time the obligation to cook the flesh of tuberculous animals has, up to the present, been only nominal in country districts owing to the lack of the necessary arrangements. Yet the health of human beings does not appear to have suffered in any way from it ; perhaps because there is no danger to human beings in the consumption of the flesh of tuberculous animals. Before the introduction of the law governing the inspection of meat, the declaration that meat of tuberculous animals was of inferior quality met with great opposition in North Germany generally, in contrast to South Germany, where it had been the custom since the beginning of the nineteenth century to grade meat of tuberculous animals as " useable, inferior, for free distribution, bad." In North Germany, owing to the knowledge of the connection between tuberculosis in human beings and animals, and the danger of the flesh of tuberculous animals, the release of the flesh of such animals as being good and of high value was, indeed, again being considered by medical and veterinary circles as doubtful. In view of the impossibility at that time of putting forward any definite proof of the harmfulness of the flesh of tuberculous animals, until the introduction of the German meat inspection laws it was not possible to bring into force any general

regulations which forbade the sale of the flesh of tuberculous animals as sound, and insisted upon its classification as inferior.

The Minden by-law of May 5th, 1891, in accordance with which the flesh of an animal which had been declared by an expert to be tuberculous could in no case be passed as sound meat, was a result of the medical opinion, openly expressed, that a single tubercle bacillus of beef could be injurious to the health of human beings. A general order of the Ministry of the Interior, dated March 26th, 1892, laid down the following for the whole state of Prussia: "Tuberculous beef, which is injurious to the health, is, by order, to be used if the flesh contains tubercles, or should that not be the case, if the animal has become emaciated . . . as . . . the transfer of the tuberculosis even from an animal with tubercles cannot be proved, and flesh of well-nourished animals cannot as a rule be regarded as inferior, and the sale thereof cannot be regulated under special police supervision. From the economic standpoint of the nation it is desirous that such meat should be allowed to circulate freely, and all the more so as a uniform examination of such meat is not possible in all places owing to deficient inspection facilities for meat in various neighbourhoods, and the entire lack of such facilities in the greater part of the country. Such meat is, therefore, in future to be allowed freely on the market; in doubtful cases the decision of an approved veterinary surgeon will be taken." Here is a case of the release of the meat of tuberculous animals for human consumption over a large area, and no harmful effects have been observed in any way or anywhere. The flesh of tuberculous animals for consumption was even allowed freely on the market, with a special reference to the effect that the sale of such meat cannot be subjected to police supervision.

On the other hand, there was the scientific attitude, which wished to draw the obvious conclusions from the supposed belief that the tubercle bacilli of men and animals were identical. E. Klens, who since the appearance of Villemin's tenet and the discovery of the tubercle bacillus in tuberculous animals, had, with Gerlach, regarded this as a special source of danger for human beings, in 1890 demanded the destruction of all tuberculous beasts by all available means. Johne's blood-infection theory seemed to him to be confirmed by the liability to infection of people with whom the "muscle-press test" denoted acute miliary tuberculosis, tested according to the method of Steinheils at the Bollingersche Institut, Munich. In connection with this, he declared that also the softness of tissue of apparently free organs is liable to infection, so that therefore the absence of tuberculous changes in animals is not decisive in determining whether they are for human consumption or not. The destruction of all animals which were at all tuberculous, and the prevention of the use of the flesh of these animals for food purposes, was desirable. The study of the identity of human and animal tuberculosis, and the resultant danger from the meat of tuberculous animals, was thus pursued to its utmost lengths. Consequently there was a deep gulf, extremely difficult to bridge, between the scientific understanding of the identity of human and animal tuberculosis and the view, for which economic necessity must make allowances, that the flesh of such animals was harmless.

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It may be said that the authorities, in their regulations during this period of dissension, allowed the view that there was no danger to human beings in the consumption of the flesh of tuberculous animals to take precedence, whilst in scientific circles a position of uncertainty prevailed. From this uncertainty arose a demand for regulations for the protection of human beings from the possible danger of tuberculous animal flesh, which demand the authorities were unable to satisfy to any great extent. Of great importance then, as a basis for the examination by inspectors on scientific lines, was the blood-infection theory propounded by Johne in 1883. From the theory that human and animal tuberculosis are identical—a wrong inference from the start—arose the theory of Johne that the flesh of tuberculous animals is always harmful to human beings when blood infection has taken place. The muscular structure, which is the part of the animal consumed, can only be infected, according to Johne, by means of the arteries and veins. Such blood infections may occur if, besides the organs primarily and secondarily affected, other organs are attacked which can only be reached by the main blood stream. Should the appearance of the slaughtered animal present any evidence that the blood had already been affected, then the meat in question, however well fed it may be, must be rejected for purposes of human consumption. Blood infection, as Ostertag said, became a favourite expression in connection with the inspection of meat.

Without Johne's agreement, Ostertag had later modified Johne's teaching. In this form it has remained until to-day—the scientific basis for the examination of the meat of tuberculous animals, although it proceeded from two false premises: firstly, the assumption that tuberculosis in human beings and in animals is identical; and, secondly, the belief that meat is a carrier of the tubercle bacilli dangerous to men. Neither of these assumptions, however, was correct. This teaching of Johne was from the year 1885 onwards being spread more and more from the Berlin abattoir (where Ostertag was then a young veterinary surgeon), first in the original form, and then in a more modified form, as the scientific basis for the inspection of meat and the protection of human beings from the dangers which, especially by the medical profession, had been regarded as being present in the meat of tuberculous animals, ever since, in 1882, Dr. Koch discovered that the same tubercle bacillus caused the disease in both human beings and animals. By adopting the Johne theory it was thought that a workable procedure had been found which satisfied the demands of hygiene, and was at the same time economically possible.

The Lower Rhine Union for the Care of Public Health declared in 1887, in a report to the Ministry, that with the increase in the number of slaughter-houses differences in the interpretation of the word " harmful " as applied to the flesh of animals had arisen. They therefore recommended, on the authority of experts, that the strictest possible standard comprehensible to all should be set for the handling of the meat of animals declared tuberculous.

Virchow declared, when reporting on the proceedings of the Scientific Deputa-

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tion for Medical Matters, that the experiments regarding the harmfulness of the flesh of tuberculous animals had had to contend with totally unexpected difficulties, and the result was fundamentally negative. Even the further progress of the experiments had given no definite results. One must accept the fact, said Virchow, that tuberculosis is a general disease, and must accordingly have a general significance; besides, there is no empirical basis put forward. For those inclined to speculate, however, no experiments will exclude the possibility that even when the disease is purely local some micro-organisms may have penetrated into the circulation and affected the meat. This attitude of Virchow explains the enforcement of the Johne blood-infection theory as practised at the Berlin slaughter-house. Here, then, were a great number of animals seized and destroyed owing to the presence of "generalised tuberculosis," which was considered dangerous to health. This strict procedure, based on the Johne blood-infection theory, was modified greatly from the year 1893 onwards, owing to the introduction of sterilisation apparatus by Hertwigs at the Berlin slaughter-house, after the Ministries of Public Instruction and Agriculture had expressed their satisfaction that sterilisation in water or steam could render the meat harmless for human consumption.

The findings of Bollinger on the subject of the infection channels of tuberculous poison, and their applicability to animals suffering from infectious diseases, which he put before the tenth International Medical Congress, and also before the sixteenth meeting of the German Union for the Care of Public Health, 1890, served largely to support this progressive measure. Bollinger declared that, according to the results of experiments on lymph, muscle tissue certainly possessed pathogenetic characteristics when high-grade and generalised tuberculosis were present. Such meat should be destroyed. On the other hand, it was possible to render individual organs of the meat declared tuberculous fit for human consumption by means of thorough boiling and longer simmering, though not by means of pickling and smoking. The same points were mentioned by Zipperlen, at the Second German Veterinary Council in Berlin in 1875, as well as by Lotha Meyer, and others. Finally, the latter declared against the confiscation of tuberculous animals, mentioning that boiling heat destroyed the tubercle bacillus, and stating that sanitary inspectors should be charged to see that tuberculous meat for human consumption was properly boiled. Later on it was recommended that this meat should be given to the public kitchens, and to the poor law institutes, as it was obviously not possible to boil the meat in the public slaughter-houses. So the acceptance of sterilisation by repeated simmering at boiling-point raised a problem that was first of all solved by Hertwig in Berlin.

Von Bollinger's proposal to sterilise the flesh of tuberculous animals for slaughter was a result of his work in connection with human and animal medical pathology. For although the Kastner experiment at his institute had proved that the muscular flesh of tuberculous animals was not a source of tuberculosis in human beings, even in an uncooked state, von Bollinger, as a doctor, did not

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trust the resultant consequences. He even stated clearly that in spite of the negative results of the Kastner experiments the flesh of tuberculous animals should not be consumed without further treatment. Von Bollinger found the bridge which enabled him to reconcile his duty as a doctor to protect mankind to his veterinary attitude which had to consider the economic side, in the proposal to sterilise the flesh of animals with tuberculous organs. Bollinger, as a doctor, was thereby freed from the reproach that the flesh of tuberculous animals, which was, according to the theory of the similarity of animal and human tuberculosis, harmful to human beings, could be released to the public without further treatment. Cooking gave rise to the possibility that the meat of tuberculous animals might be definitely considered as being harmless for human consumption. On the other hand, however, the possibility of harmfulness still exists, and in the examination of meat the more definite opinion prevails in order that the transmission of animal contagion to human beings may be avoided. So, owing to Bollinger's efforts by means of the introduction of compulsory cooking of meat which was considered to be attacked by blood infection, the blood-infection theory of Johne was modified considerably, indeed it was modified to such an extent that, in place of complete destruction of the carcases of tuberculous animals, boiling of the meat was adopted. Also the original method of destruction of the quarters of animal carcases (in the case of inter-muscular tubercles which denote the presence of blood-infection) was modified to the extent that these quarters likewise were submitted to compulsory sterilisation, provided that the examination of the organs did not prove the presence of generalised tuberculosis, which necessitated the boiling of the entire carcase.

Johne's blood-infection theory had been further modified in that Ostertag declared that Johne's theory with regard to the complete destruction of the meat, even of the best fed beasts, was not in the main conclusive. To wit, because Ostertag was unable to demonstrate any danger in the form of tubercle bacilli in experiments on those beasts which according to the Johne theory were harmful and should be destroyed, he created the idea of " expired generalisation," which as a hypothesis allowed innumerable tuberculous cases to be saved from destruction, and also from compulsory cooking. On the other hand, exhausted blood-infection was followed by fresh blood-infection, which again caused the meat of tuberculous beasts to be regarded as harmful.

There existed thus, up to the introduction of the German law governing the inspection of beasts for slaughter purposes, a very different method of judging the flesh of animals between the slaughter-houses which were under veterinary supervision, and the extremely kind-hearted method of judging animals at country slaughter-houses. In each case the harmfulness or otherwise of the flesh of tuberculous beasts was the foremost question. However, the introduction of compulsory cooking did not produce any positive knowledge as to whether the flesh of these animals is actually harmful to human beings, or whether it is only the fear of this danger due to the belief in the identity of the bacilli and to Johne's

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blood-infection theory. This assumption was also not to the point, because the muscular tissue of the tuberculous beasts for slaughter is almost always free from bacilli, or at most contains single bacilli of the bovine type, from which the actual human tuberculosis is not derived. From these erroneous presumptions there resulted, however, at the slaughter-houses a useless cooking of the flesh of tuberculous animals, whereas in the country, until the introduction of the inspection law, the slaughter of cattle and inspection of meat knew nothing whatever of cooking.

The Diagnosis of Weil's Disease in the Dog. By A. KLARENBEEK and Miss J. VOET. *Tidschrift voor Diergeneeskunde.* No. 59, December 1st, 1932.

THE many instances in which Weil's disease has been observed in human beings during the last few months have again focussed attention on this disease in the dog. The question whether infection is due to an infected dog naturally crops up. Instances where direct contact with outside pools (swimming) did not exist have to be taken into consideration. Food infected by rat urine or leptospiratic dog urine may be considered the most probable source of infection in these patients. As regards this question of infection, dog leptospira will have to be considered as the most important object of our study. The investigations conducted in our institute during the last few years have shown conclusively that this disease is not by any means a rare one in dogs. In 1930 approximately twenty dogs were diagnosed as having Weil's disease, whilst during the last few months no fewer than ten dogs have been treated for leptospira. A systematic examination of the blood of dogs taken at random shows, by the lysolating action on the leptospira cultures introduced by Korthof, that many dogs which are apparently completely normal have in all probability been infected by leptospira. As has been proved by us during the course of recent years, the progress of this disease, although roughly corresponding in all cases, does show a tendency to vary in many ways. Those dogs which clinically show the symptoms of chronic kidney trouble to a greater or lesser degree, but with which leptospira have been diagnosed in the urine, form an interesting group of patients.

If a dog has been artificially infected with leptospira intravenously, or by means of intra-peritoneal vaccine by culture, the disease will take approximately the course of the illustrated diagram. The symptoms shown will not always be so clear; many will not even be found. By this diagram, however, we believe we have demonstrated clearly the spontaneous course of the disease. The first symptoms in a spontaneously infected dog will in all probability become apparent on the third or fifth day after the infection. A sudden listlessness and vomiting, which need not be very severe, and a lack of appetite, show that the dog is not well. The registration of the temperature in this stage of the disease would be a valuable indication, because a sudden rise and a decrease as sudden as the rise would be observed in most cases. The conjunctively-apparent strong corpuscle

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injection in conjunction with the very clearly apparent corpuscles in the conjunctiva ("bindvlies") of the eye forms important evidence. It differs from the conjunctivitis which occurs in ordinary dog diseases; the diffuse redness, the photophobia, and soon the purulent secretion, became apparent; with the conjunctive corpuscle injection for Weil's disease the purulent secretion does not appear, and often every abnormal secretion is absent, whilst sometimes a sero-mucous substance is observed flowing out of the eye.

It is very seldom, however, that the patient will come in for treatment at this stage of the disease, since the symptoms have not existed for long, and are not very alarming. Usually it is left over for a few days. Not until, experienced by former cases, one is alert will the disease be diagnosed as Weil's disease. If a small drop of blood from the ear, obtained by a Pasteur pipette, is examined on a black field, the leptospira will not seldom be found in this stage of the disease. The possibility of obtaining a blood culture is only likely for a few days after the infection. Usually an improvement in the general condition occurs after the sudden fall in temperature, although the lack of appetite is not entirely rectified, and the conjunctiva injection still remains, but vomiting does not occur again, and the patient is usually a little less listless. As a general rule, between the seventh and tenth days, shortly after the fall in temperature, the icterus becomes apparent, sometimes slowly, sometimes in one day, and the mucous membrane colours yellow, whilst also the skin on the inside of the ear and between the hind legs discolours to yellow. The diagnosis can often be determined by the ochre-coloured sclera of the eye, and sometimes by the movements of the eye. At the same time listlessness increases, and the animal has a general lack of interest: it follows every movement with the eye, but does not lift the head from the ground or from its basket, generally giving the impression of having a severe headache.

From now on symptoms are very vague; clinical examination yields no particulars; the temperature does not increase above normal, whilst with jaundice a lower temperature is apparent, often below normal (37–37½°). Sometimes small blue-black spots can be seen in the mucous membrane. The most important change in this stage of the disease is the appearance of the urine. The patient, which sometimes appears to be too apathetic to drink, but in other cases shows a normal or increased thirst, passes a usually ochre to coffee-brown thick urine, which is mostly well concentrated, and has a slightly sour or alkaline reaction. The white of egg and gall-colour reaction are usually positive, whilst the blood reaction is repeatedly positive to a greater or lesser degree. There is usually a good deal of sediment which generally contains granulated cylinders, kidney epithelia, red blood vessels, leukocytes, and epithelias of the urine channels; in many cases it will appear to be acute tubular nephritis.

In this stage an attempt to locate leptospira on the dark field is usually successful. A drop of urine in slides may contain numerous strongly vital and quickly rotating leptospira, but it is also possible that in various cases only a

few living leptospira appear in the field of sight. It is even possible that the search for leptospira in the urine of dogs in which infection has been definitely diagnosed may fail altogether. Some examples may even be entirely motionless or have slow movements. This symptom may be observed specially in acid urine, and may be explained as a tendency in the leptospira to be particular as regards the medium. For the culture, too, a certain Ph corresponding to the alkaline milieu is essential. In order to combat infection this symptom is important, for when a diet is composed which will cause the urine to be sour, or to remain sour, the chance of separating live infectious secretions is lessened. This can be attained by giving salty-sour drink and a diet of meat.

The further course of the disease from the clinical viewpoint is jaundice. Experiments conducted in our institute extending over many years have demonstrated that normally all cases of acute yellowness in the dog are not caused by catarrh icterus, but by infection with Weil's leptospira. For the veterinary surgeon the yellow discoloration of the skin, and especially the discoloration of the mucous membrane, is as a lightship to the navigator, and he is completely justified if he diagnoses the disease as being most likely Weil's disease. The fact, however, that in many instances the disease will not show jaundice makes it an extremely difficult one to diagnose for the veterinary surgeon who has as yet little experience. It is therefore commendable that there are surgeons who send animals which are entirely free from jaundice, but which are, nevertheless, suspected of Weil's disease, to our clinic for observation. The jaundice stage may be of varying lengths ; sometimes even the yellow discoloration entirely disappears in a few days from the mucous membrane and skin ; the patient becomes less and less listless, and usually makes a quick recovery in every way. Generally, however, the jaundice period is longer, whilst sometimes the icterus will remain for weeks on end. The animal during this time is listless, lacks appetite, and generally is not thirsty in the beginning ; it loses weight slowly.

The animal is usually brought to the clinic at the beginning of the jaundice stage, thus when the disease is approximately ten days old. The lack of appetite coupled with listlessness make the owner anxious, whilst the dark urine passed and sometimes also the yellow discoloration of the mucous membrane and skin have compelled his attention. The diagnosis which is arrived at after an accurate clinical examination (differential diagnosis, intoxication, with blood and liver changes, liver cirrhosis, liver tumours, invagination, obstruction in the small intestine caused by a corpus alienum, uræmetry) is in all probability correct. The symptoms of leptospira, which demand an examination in the dark field, again usually take place outside the well-equipped laboratory. By sending in specimens of the urine to institutes equipped for this kind of research, the presence of dead or alive leptospira can often be proved. The examination of the blood in the later stage of the disease may also prove the accuracy of the diagnosis by demonstrating its lysating propensities. The diagnosis of the disease is much more difficult, of course, in the case of animals which have no jaundice.

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These animals, too, are brought to the clinic for treatment not much later than the jaundice patients, because there is always the lack of appetite and the general apathy. With these animals kidney trouble is the principal clue, and this, with anamnesis, gives rise to a serious assumption that the animal is infected with Weil's disease.

How far the frequent kidney trouble of the dog is directly connected with this disease, is a question which we must leave out of this discussion. It is a certainty, however, that in many cases where kidney trouble has been established, and where the animals are listless and emaciated owing to total loss of appetite, the presence of leptospira will be proved in the urine. If these patients come up for treatment in the early stage, for instance, ten to fourteen days after infection, this kidney trouble will often be of the acute parenchymatous nephritis type, whilst in those cases which come in with jaundice, the gall-discoloration substance will also be present. It is also possible though that the patient will come up for treatment at a later stage ; the kidney trouble will then be observed at a much more advanced stage, wherein many of the clues which govern the diagnosis clinically will not be present. We have before us then an animal which has lost weight, and which often shows anorexia, drinks a little, but usually more than normal, and prefers water, whilst the examination of the urine points to chronic nephritis. As is the case with jaundice patients, investigation of the urine on a dark field will confirm the diagnosis. With these patients the urine may contain many or few leptospira.

Besides confirming the diagnosis by proving the presence of leptospira, first in the blood and later in the urine, the lysolating propensities of the blood of a sufferer from Weil's disease in relation to leptospira can also be sufficient proof of the correct diagnosis. Already during the stage of jaundice, usually in the second week after infection, the blood shows this characteristic. As a general rule it may be said that the Dutch variety taken from human beings, rats and dogs, shows in this respect strong biological characteristics. It has been found that the lysis-titer disappears soon after the disease to a certain extent, and disappears completely after six months. The leptospira in the urine may or may not disappear suddenly. Sometimes it does so in one or two weeks, whilst in other instances the dog shows none of the symptoms of the disease any longer, and the functioning of the kidneys has also resumed its normal course, but leptospira can be found for weeks on end in the urine, as has been shown by experiments. The conclusion of this is that for a long time after the disease has disappeared the dog can be a source of infection, especially as it is apparent that the leptospira in the urine are virulent to the cavy.

The prognosis must take the stage of the infection into account. The first stage, in which an increase in the temperature is observed, gives many facilities for correct treatment. It has been found that treatment with serums, as applied to human beings, is the best and most successful at this stage (Schueffner). Cases in which icterus gravis occurs together with severe tubular nephritis usually

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end in death after ten days. Long-standing jaundice with nephritis weakens the animal to a great extent, and often causes its death. The course of the disease is, however, more favourable in the less severe cases.

It is of the greatest importance to get the animals to eat sufficient food. The digestion will usually take the following: soups, milk foods, grated meat, and a little vegetable. The use of acid drinks can have an advantageous effect, they serve as a digestive and also make the urine acid, thus hindering or entirely preventing the secretion of live leptospira. Leptospira is a prevalent disease in our country, and is probably responsible for the spread of this disease to human beings. Moreover, it is a factor which can explain the origin of kidney trouble in a dog.

Summary.

Weil's disease is not infrequently observed in dogs, and does not always show the clinical symptoms which go with jaundice. Often the kidney trouble will be most noticeable. From the point of view of infection, it is essential that this disease should be diagnosed. The methods of examination which lead to correct diagnosis of this disease are described in the above article.

LYSOLATING IN BLOOD CULTURES.

37.5–38°C.	3rd–5th day.	7th–10th day.	
Infection.	Loss of appetite.	Commencement of leptospira in urine.	Recovery—return of appetite, or commencement of chronic stage.
	Vomiting.		
	Leptospira in blood.	Icterus with often a decrease in temperature.	
	Conjunctival (?) corpuscle.	Apathy—lack of appetite.	
	Injection.	Parenchymatous ← Nephritis →	Chronic.

Reviews

Animal Diseases in South Africa. By M. W. HENNING, *Professor of Veterinary Science in the Faculty of Agriculture, University of Pretoria.* "South African Agricultural Series," Vol. XII. Price £2 10s. 6d. per set of two vols.

As pointed out in a Foreword by Dr. P. J. du Toit, fifty years ago little was known about animal diseases in South Africa, but since then, thanks to the work of Theiler, Hutcheon, and others, much knowledge concerning them has been acquired, and the literature dealing with them has become very extensive, although not readily accessible to the student of veterinary science. In collecting and collating the known facts about the commoner diseases of farm animals, Professor Henning has performed a valuable service. He has shown admirable judgment in selecting only those diseases which are of peculiar interest in South Africa, and he has dealt with them in an interesting and thorough manner. The book is intended primarily for veterinarians and veterinary students, but many sections of it should appeal to others interested in stock and stock diseases. The work is published in two volumes. The first consists of Part I, devoted to bacterial diseases, including anthrax, blackquarter, malignant œdema, swelled-head in rams, tetanus, bloodpens in lambs, paratyphoid disease in calves, contagious abortion, tuberculosis, glanders, epizootic lymphangitis, strangles and lamsiekte.

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Part II deals with protozoal diseases, such as redwater, gall sickness, East Coast fever, equine biliary fever, canine biliary fever, trypanosomiasis, and spirochætosis of swine. It concludes with a carefully compiled index, and contains as many as forty-three excellent illustrations.

Volume II consists of Part III, on virus diseases, and devotes chapters to the consideration of rinderpest, foot-and-mouth disease, lungsickness, snotsiekte, three-day sickness, sweating sickness, blue tongue, horse sickness, heatwater, swine fever, African virus disease of pigs, Canine distemper, rabies and tick paralysis. Part IV is devoted to diseases caused by poisonous plants, and Part V to deficiency diseases. It is also followed by an index, and contains as many as eighty-four illustrations. It is to be regretted that the diseases caused by intestinal and other worms are not included, but it is hoped that these will be dealt with in a third volume, which will be eagerly awaited by the many readers who will no doubt appreciate the first two, which are carefully printed and elegantly produced by the Central News Agency, Ltd., South Africa.

News

THE MILK COMMISSION'S REPORT FROM THE FARMERS' STANDPOINT.*

THE Reorganisation Commission for Milk was appointed in April, 1932, by the then Minister of Agriculture, Sir John Gilmour. He acted on his own initiative in setting up this Commission along with the Reorganisation Commission for Pigs and Pig Products, and there were significant differences in the terms of reference to the two bodies. The report of the Milk Commission, which has been eagerly awaited, was published on February 6th, and it is to be noted that their most important recommendations admittedly " fall outside the scope of the Marketing Act." Indeed, so far as dairy farmers are concerned, the real question with which the report confronts them is not whether they will give their support to a scheme under the Agricultural Marketing Act pure and simple, but whether they will ask for a measure of statutory control of the milk industry, to be provided by fresh legislation, which would in effect extinguish the right offered them by the Act of 1931 to regulate the marketing of their produce in accordance with its provisions.

In drawing up their reorganisation proposals, the Commission proceeded on the assumption that " the regulation of the liquid market is the problem of immediate concern to the industry," a circumstance which doubtless explains the limited character of their recommendations in respect to the control of imports of milk products. The fact that the Commission did proceed on that assumption makes it all the more important that the Import Duties Advisory Committee should lose no further time in considering the joint representations submitted to them last year on behalf of the milk industry in respect to increased import duties on various milk products, and that the Minister of Agriculture himself should deal at once with the question of the quantitative restriction of certain milk product

* National Farmers' Union News Sheet, February 6th, 1933.

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imports, notably cheese. The promise given by Lord de la Warr on behalf of the Government in respect to control of imports as a necessary corollary of marketing organisation cannot be overlooked in this connection.

The Milk Commission propose that the work of reorganisation should be carried out by a Central Producers' Board (constituted under the Agricultural Marketing Act) with regional committees; but to balance the producers' organisation there would be set up a statutory Central Dairymen's and Manufacturers' Board, and for purposes of determining contract terms and conditions, etc., the two boards would combine to form a Joint Milk Council, also on a statutory basis, with three additional appointed members, one of whom would be chairman. The appointed members, in order to preserve the goodwill of the consumer, are to " have the final voice in the negotiations by which prices are fixed " ; indeed, " it will not be possible for a majority of the Council to enforce proposals which the appointed members do not approve."

As regards the Producers' and Dairymen's Boards, the latter apparently would be composed exclusively of representatives of the dairymen and manufacturers themselves, but the producers are told that their organisation would benefit by " drawing some at least of its directing ability from outside the industry altogether." Thus, in order to secure the introduction of " directors of wide vision and business ability," five of the seventeen members of the Producers' Board would be " special " members, to one of whom, it is suggested, should be allotted the " duties and responsibilities of the Chairmanship of the Board."

The salient features of the Commission's scheme are, of course, the magnitude of the machinery involved ; the tremendous powers which would be vested in the appointed members of the Joint Milk Control; and, thirdly, the fact that milk producers would never know from month to month what price they would receive for their output. The proposals are of a most far-reaching character, and will undoubtedly require very serious consideration at the hands of dairy farmers. It would be idle at this date to speculate upon the probable attitude which milk producers will adopt towards the report, but it would be ungracious not to recognise at once the great thoroughness with which Sir Edward Grigg and his colleagues grappled with the very difficult task which Sir John Gilmour entrusted to them. It rests entirely with producers themselves to determine the form of any milk marketing scheme which they may desire to submit to the Minister of Agriculture, and there is no obligation upon them to accept the Commission's scheme as it stands. The report is a bulky document. With its appendices it runs to over two hundred pages, and copies are being circulated at once by N.F.U. headquarters to the members of the Union's Milk and Dairy Produce Committee, and the proposals will also be examined without avoidable delay by the Union's County Branch Milk Committees. When that examination is completed it will be possible to gauge the reactions of milk producers to the Commission's proposals.

(" Report of the Reorganisation Commission for Milk." Ministry of Agriculture's Economic Series, No. 38. Price 6*d*. net, from H.M. Stationery Office, or any bookseller.)

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AGRICULTURAL MARKETING ACT, 1931.

CONSTITUTION OF REORGANISATION COMMISSION FOR FAT STOCK.

THE Minister of Agriculture and Fisheries (Major the Rt. Hon. Walter E. Elliot, M.C., M.P.) has constituted an Agricultural Marketing Reorganisation Commission for Fat Stock. The duty of the Commission will be to prepare, in accordance with the provisions of the Agricultural Marketing Act, 1931, a scheme or schemes, applicable in England and Wales, for regulating the marketing of fatstock, and, in the course of preparing any scheme as aforesaid, to investigate and report on any matter which appears to them to affect its operation, and in particular to investigate and report on the manner in which its operation could be facilitated: (*a*) By co-operation between the board administering the scheme, and (i) any corresponding board in Scotland or Northern Ireland; (ii) any board that may be constituted in Great Britain or Northern Ireland for regulating the marketing or pigs or of bacon; and (iii) any organisation concerned with the marketing in the United Kingdom of fatstock or meat produced in the United Kingdom or elsewhere. (*b*) By the regulation of imports of livestock or meat, or any product thereof. (*c*) By improvement of the facilities for the slaughter of fatstock, and for the production of commodities therefrom. (*d*) By use of the provisions of the Agricultural Produce (Grading and Marking) Acts, 1928–31.

The composition of the Commission is as follows:

Chairman: Colonel the Rt. Hon. George Richard Lane-Fox, P.C., J.P., D.L., M.P. for Barkston Ash Division (Yorks, W.R.) 1906–1931; Secretary for Mines, 1922–24 and 1924–28; member of Indian Statutory Commission, 1928–29; Chairman, Reorganisation Commission for Pigs and Pig Products, 1932.

Members: Harold Gibson Howitt, D.S.O., M.C., F.C.A., Chartered Accountant; partner in Peat, Marwick, Mitchell & Co.; Member, Reorganisation Commission for Pigs and Pig Products. Sir John Buck Lloyd, Kt., Financial Director of Anglo-Persian Oil Co., Ltd.; Director, National Provincial Bank; partner in Shaw, Wallace & Co., India, Ceylon, and R. G. Shaw & Co., of London. John Boyd Orr, D.S.O., M.C., M.A., M.D., D.Sc., F.R.S., Director of Rowett Institute for Research in Animal Nutrition, Aberdeen; Director of Imperial Bureau of Animal Nutrition; Research Lecturer in Physiology of Nutrition, Aberdeen University. The Hon. Jasper Ridley, Director of Coutts & Co.; Chairman of the Ocean Accident and Guarantee Corporation; Member, Reorganisation Commission for Pigs and Pig Products.

The Secretary of the Commission is Mr. J. B. Baber, M.C., T.D., and the Assistant Secretary, Mr. W. H. Wilkin, both of the Ministry of Agriculture and Fisheries. Communications for the Commission should be addressed to the Secretary at 3, Sanctuary Buildings, Great Smith Street, Westminster, London, S.W.1.

THE NATIONAL GREYHOUND RACING SOCIETY.

COUNCIL.—*President:* The Lord Askwith, K.C.B., K.C. *Vice-Presidents:* Sir William Gentle, J.P.; Maj.-Gen. The Lord Loch, C.B., C.M.G., D.S.O. *Members:*

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Brig.-Gen. A. C. Critchley, C.M.G., D.S.O.; Admiral Sir Sydney Fremantle, G.C.B., M.V.O.; W. H. McGrath, Esq.; Lt.-Col. H. A. Browne; H. Garland Wells, Esq.; Capt. M. W. A. P. Graham, M.C.; W. J. Cearns, Esq.; James B. Fraser, Esq; Lt.-Col. E. L. Mears, D.S.O.; Lt.-Col. G. R. Powell, O.B.E., J.P.; Sir Louis Dane, G.C.I.E., C.S.I.; F. S. Gentle, Esq.; W. H. Campion, Esq., J.P.; W. H. Campion, Esq., J.P.; A. J. Elvin, Esq. *Secretary:* Major C. E. Lucas Phillips, M.C.

THE NATIONAL GREYHOUND RACING CLUB.

Stewards: Henry Sawtell, Esq.; The Lord Lawrence, D.L.; Captain C. R. Jorgensen; Brig.-Gen. The Hon. Alick Russell, C.M.G., D.S.O.; Sir Frederick T. G. Hobday, C.M.G., F.R.C.V.S.; Captain B. F. R. Fairfax-Lucy. *Secretary:* Lieut.-Col. Romer Baggallay, D.S.O., M.C.

Official Statistics for 1932.

The following are the official statistics of the fifty greyhound racecourses affiliated to the National Greyhound Racing Society, and licensed by the National Greyhound Racing Club:

Total Attendances—		
	1927	5,656,686
	1928	13,695,275
	1929	15,855,162
	1930	17,119,120
	1931	17,906,917
	1932	20,178,260
London—		
	1928	6,451,417
	1929	7,848,638
	1930	8,619,217
	1931	8,608,382
	1932	9,023,156
Manchester—		
	1928	1,402,988
	1929	1,705,756
	1930	1,724,406
	1931	1,708,433
	1932	1,743,814
Glasg w—		
	1928	1,457,673
	1929	1,542,653
	1930	1,607,431
	1931	2,037,350
	1932	2,335,954

Total Prize Money paid to owners of greyhounds, exclusive of stakes and the value of trophies (1932): £388,463.

Total Entertainments Tax (1932): £222,550.

Total Payments to Charities (1932): £17,950.

Total Payments to Local Rates (1932): £42,790.

Obituary.

THE LORD LOVAT.

THE Royal Veterinary College and, indeed, the whole veterinary profession have lost a great friend by the death of The Lord Lovat, K.T., K.C.M.G., K.C.V.O., C.B., D.S.O., and this is especially minded at the present time when the completion of the erection of the first of the new buildings of the Royal Veterinary College is so near; for it was owing to the official visit (at the invitation of the Principal of the College) of Lord Lovat (as Chairman) and a Deputation of the Committee of the Colonial Veterinary Services Organisation Committee, that the Government Departmental Committee (the report of which has caused the commencement of the rebuilding of the College) was set up. The remarks of the members of the Committee at the time as to the appalling and disgraceful conditions under which the College work had to be carried on, was emphatically expressed, and is briefly summarised in the paragraph: "We do not hesitate to say that we were dismayed by what we saw." The date of their visit was a fortunate one for the College, and the late Lord Lovat's interest and influence were used to the utmost until the matter was safely placed in the hands of the Government Departmental Committee, whose findings have now received sufficient support to enable the rebuilding scheme to be satisfactorily launched.

A man of great courtesy and kindly character, and with a disposition ever ready "to right the wrong," Lord Lovat's name will always be remembered as one of those who were not only able to help veterinary science, but who actually did so at a time when the oldest and most famous of its teaching colleges was on the verge of bankruptcy and probable extinction.

Notices

THE SOCIETY OF RADIOGRAPHERS.

THE Society of Radiographers, which was founded in 1920 for the purpose of bringing together the trained and skilled workers in the science and art of radiography, has elected Mr. C. W. Furby as its President for 1933. Mr. Furby, who holds the position, in conjunction with Mr. H. J. Ede, of Honorary Radiographer to the Royal Veterinary College, is very popular with both staff and students, and has a large *clientèle* amongst members of the veterinary profession.

Publishers' Notices

All communications should be addressed to 7 & 8, Henrietta Street, Covent Garden, London, W.C. 2. Telephone: Temple Bar 4646. Telegrams: "Baillière Phone, London."

Letters for the JOURNAL, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

Copy of advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 25th of the month, or if proof is required, not later than the 23rd.

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